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T*Ractatum hunc cui Titulus* Eſſays of Anatomy, *dignum judicamus qui Imprimatur*,

Samuel Collins, *Præſes.*
Thomas Burwell,
Richard Torlesse, *Cenſores.*
William Dawes,
Thomas Gill,

Dat. in Comitiis Cenſoriis
ex adibus Collegii Noſtri
Dec. 6. A. D. 1695.

43930

ESSAYS OF ANATOMY,

Wherein the Formation of the

ORGANS

AND THEIR

MECHANICAL OPERATIONS

Are clearly Explained, according to the New

HYPOTHESES.

By Monſ. BEDDEVOLE, *Dr. of Phyſick.*

Written Originally in French.

The Second Edition.

LONDON,

Printed for *Walter Kettilby*, at the *Biſhop's Head* in St. *Paul's Church-Yard*, 1696.

WELL
HIS

TO THE
RIGHT HONOURABLE
THE
Viſcount of *TARBAT.*

My LORD,

THE following Treatiſe receiving the Approbation of a moſt ingenious Piece, it has encouraged the making and publiſhing this Tranſlation, to ſupply the Scarcity of French *Copies, and to ſatisfie the Curious, who do not underſtand that Language. And ſeeing the Author of the* Eſſays, *lately Deceaſed, had the Honour of your Lordſhip's Acquaintance, as well as the Favour of your good Opinion, I preſume your Lordſhip will be eaſily induced to take this Tranſlation under your Patronage and Protection.*

The worthy Author was pleaſed to write to me ſome other of his Thoughts, about the ſame Subject; but to my great Regret his Letter did unhappily miſcarry, otherwiſe I might likewiſe have gratified the Publick with thoſe Sentiments of his. My Lord, I preſume to prefix your Lordſhip's Name to this, which I know will be the more acceptable, becauſe I ſhun that Flattery which is but too common in many Dedications: And do with all Submiſſion ſubſcribe my ſelf,

MY LORD,

Your Lordſhip's

moſt humble Servant,

J. SCOUGALL.

THE PUBLISHER's Advertiſement TO THE READER.

THoſe that judge of a Book by the Title, are Diſcouraged at an Inartificial one; and on the contrary, believe the Work valuable that is ſet off with a well contrived one. We might doubt of their acceptance of this little Treatiſe, if many others which have appeared with the ſame Modeſty, and have neverthleſs had a great Succeſs, had not favourably diſpoſed the Reader for the word *Eſſays*. Since thoſe of the

Famous *Montaigne*, how many others have appeared in *Phyſick* and *Morality*, which have gain'd the Applauſe of the Learned? I hope therefore that they will not be prejudiced againſt this preſent Treatiſe, becauſe it promiſeth nothing but *Eſſays*, and that they will have the patience to ſee what it *ſays*.

The AUTHOR's

PREFACE.

THE *knowledge of the* Living Body *is extremely neceſſary for* Phyſicians: *Without it they practiſe at random. This is a* Flambeau *which gives them* Light *in the* Cauſes *of* Diſeaſes, *and in the* Choice of Remedies. *And all that underſtand nothing of it, can reaſonably be concluded no other than* Empiricks.

The Judicious *and* Ingenious Men *have always acknowledged this. For this it is they have ever ſtudied* Anatomy *with the greateſt Application. In* Ages *paſt they thought they had attain'd to a Perfection in it. But in this they have found,* *to the ſhame of* Phyſicians, *that they have made but a very ſmall Progreſs.*

Former Ages were ſo prepoſſeſſed in favour of the Ancients, *that they never aply'd themſelves to learn any thing but what theſe had diſcovered.* Hippocrates *and* Galen *only were then ſtudied. They ſought in their* Writings, *all that they were obliged to know to render them accompliſh'd in their Art. They imagin'd they knew all, and took thoſe for* Viſionaries, *who pretended to know more than theſe: And this is the reaſon they have been ſo extremely barren in their* Diſcories.

But, Thanks to the Penetration *of an excellent* Philoſopher *of this Age, it has been diſcovered that the* Living Body *is only a* Machine. *Men have applied their Minds to diſcover its* Springs. *In this* Harvey *and* Pecquet *have been ſucceſsful.* The Circulation of the Blood *has Immortaliz'd the one, and the* Reſervatory *of the* Chyle *and the* Ductus

Thoracicus, *has given the other an Everlaſting* Reputation.

Their Example has animated all Anatomiſts. *They found they had made ſmall progreſs in the knowledge of this* Machine. *They were perſwaded that they needed but ſearch to make* Diſcoveries. *In effect the* Bartholin's, *the* Wharton's, *the* Steno's, *the* Willis's, *the* Gliſſon's, *the* Lower's, *the* de Graaf's, *&c. and above all the* Malpighii *have ſearched very narrowly into the* Structure *of the* Living Body. *The* Diſcoveries *which they have made give us an* Idæa *of an* Animal, *altogether different from what the* Ancients *had of it.*

It might ſeem that after them, there remained nothing to be Diſcovered. *Nevertheleſs there are* Treatiſes *frequently publiſhed, which tontain ſome new thing, and I doubt not but an hundred years hence they may make ſome new* Diſcovery.

The Contrivance *of the* Body, *is neceſſary for explaining the* Office *and* Function *of its* Parts; *and if what we fancy to be the* Contrivance, *is not ſufficient for* *the Explication of the* Operations *of the* Body, *nor the* Effects *of its* Particular Members *and* Parts, *we may conclude there is ſomething of this* Contrivance *yet to be* Diſcovered. *The beſt* Anatomiſts *ingenuouſly acknowledge, that they fail in many* Particulars; *there are therefore many* Diſcoveries *yet to be made.*

Some of them will be found in theſe Eſſays; *and to me they ſeem* Important *enough to make me believe that they will not be unacceptable. I do not conceive the ſame hopes of my* Sentiments, *concerning the nature and uſe of the* Liquors *which are found in the* Living Body. *To thoſe who are prejudiced, the Novelty of the moſt part of them, will make them ſeem extravagant. But I hope thoſe who do not condemn an Opinion, without having examined it, will do me the favour to believe, that if they find them Erroneous, I was not haſtily miſtaken without good and probable inducements.*

I ſhall only beg of them to Read the firſt Treatiſe *of theſe* Eſſays, *before they read the*

the reſt. It gives the Idæa *which I make to my ſelf of the* Elements, *and without it, they will not conceive ſo diſtinctly what is contain'd in the reſt.*

There is a great Connexion between all the Treatiſes *of theſe* Eſſays: *Thoſe who would underſtand them well, will not do ill to read them in Order. The Order which I give them will ſeem Fantaſtical to thoſe who are accuſtomed to read Courſes of* Anatomy *written according to the Ordinary Method. But they who ſhall obſerve that each* Treatiſe *ſerveth for the underſtanding of that which followeth, will acknowledge that I have given them a* Natural Order.

Perhaps it may be thought ſtrange, that I make no mention of Authors *in the places where I ſet down their* Diſcoveries. *They may perhaps think that I do it on Deſign, to attribute to my ſelf the Glory of them. In this they would do me a great Injury. I am not ſo baſe as to acquire Reputation at the Expence of that of others. But I have not nam'd thoſe who have made the* Diſcoveries,

veries, *becauſe every Body knows them, and it would be of no uſe for the underſtanding of theſe* Eſſays, *if they had been quoted.*

There is an excellent Anatomiſt *at* Montpellier, *who is called Monſieur* Chirac. *The firſt reaſon which has made me wave the Names of others, has no place as to him. Neverthelefs, I have not Nam'd him any where. But I'll do him Juſtice here. It is he who has written to me, that all the* Glandules *were nothing but heaps of* Circumvolutions of Veſſels; *after which I have told him,* That by chance I have obſerved ſomething like to this in the *Proſtatæ* of a Dog.

Moreover, almoſt all Authors place their Names in the Frontiſpiece of their Works. This probably flows from the good Opinion that every one has of his own Productions. *Every Body is fond of them. There is ſcarce a ſilly* Scribler, *who does not imagine that his Work has ſomething of Tranſcendent in it. Though for the moſt part it is nothing but a Mutilation of good* Authors.

By this you may know the reaſon why I do not as others. I have no ſuch Opinion of this Work as to imagine it will do me any great Honour: Beſides I Write but to expoſe my Thoughts *to others, to the end, that if they be wrong, they may Correct them, and if they be right, they may help forward to better.*

THough the Author's Modeſty would not allow him to put his Name to theſe *ESSAYS*, yet He being now dead, and They having received their Approbation of the Learned College of Phyſicians, the Tranſlator thought fit to do him Juſtice, by putting his Name to this Edition.

ESSAYS OF ANATOMY.

DISCOURSE I.

Of the Elements of a Living Body.

SECT. I.

Of the firſt Elements.

THE *Idea* that we have of Matter and Motion, leads us to think, that all Bodies are compoſed of Inſenſible *Corpuſcles*, of different Magnitude and Figure. If it fall out that many of theſe *Corpuſcles* are united, they compoſe little Maſſes, which we call *Moleculæ.* And if they continue ſeparated from one another, by reaſon of great Agitation, they compoſe a Matter which we ſhall nominate the *Æthereal Matter.*

Notwithſtanding the *Moleculæ* are formed by the meeting together of the parts of the *Æthereal Matter*, yet there is amongſt them an almoſt infinite Diverſity, as well in reſpect of their Magnitude as their Make and Figure. This will be ſufficiently evident to thoſe who ſhall conſider, that the parts of the *Æthereal Matter* are very different from one another. For this Reaſon it is that the *Moleculæ* which are made up of them, are ſo different one from another. Now ſince we have no reaſon to deny, but that they are of infinite kinds, we may well think that they differ amongſt themſelves an infinite number of ways, as well in reſpect of their Magnitude, as of their Make and Figure.

To examine well the differences of their Structure and Figure; all the *Moleculæ* may be conveniently reduced to five kinds. The firſt ſhall be of thoſe which have *ſharp Angles* on their Surface with much Solidity: We ſhall call theſe kinds of *Moleculæ*, *Acids.* The ſecond ſhall be of thoſe which have many Pores, great and open: Theſe we ſhall name *Alcali's.* The third ſhall be of thoſe which are branched, which we ſhall call *Sulphurs.* The fourth ſhall be of thoſe which are long, and their Extremities like thoſe of an Oval:

We ſhall name theſe *Phlegm.* And in fine, the fifth ſhall be of thoſe, which have not ſharp Angles on their Surface, which are not very Porous, which are not branched, and which are not Cylindrical with Oval ends; but which are either round, or Oval, or rough, *&c.* and theſe we ſhall term *Earth.*

The *Æthereal Matter* flows without ceaſing through the Pores of the *Moleculæ:* It fills alſo all the ſpaces where there are no *Moleculæ*; and theſe *Moleculæ* compoſe all thoſe Bodies which we call *Terreſtrial.*

A living Body is one of theſe Terreſtrial Bodies which are compoſed of *Moleculæ:* Therefore *Acids*, *Alcali's*, *Sulphurs*, *Phlegm* or *Earth* muſt needs be in it. Since therefore we have propoſed to give a clear *Idea* of its Elements in this Diſcourſe, we ſhall examine the nature of *Acids*, *Alcali's*, *Sulphurs*, *Phlegm* and *Earth.*

SECT. II.

Of Acids.

TO underſtand well the Nature of *Acids*, we muſt examine their Figure, their Structure, and their Magnitude. As to their Figure, when I examine the matter more narrowly, I obſerve that there is amongſt them almoſt an infinite difference. There are Conical, Triangular, Regular and Irregular of all ſorts: There are of them whoſe Angles are very ſharp, and others of them whoſe Angles are leſs ſharp. There are ſome that have many Angles, and others that have not ſo many. And ſince there may be amongſt all this an Infinity of different Modifications, we make no ſcruple to ſay, that there is almoſt an infinite difference amongſt *Acids*, by reaſon of their Figure; which makes me think, that it would be a fruitleſs labour to endeavour to know all the differences which are amongſt the *Acids*, by reaſon of their Figure. The multitude of them being Infinite, we cannot hope to know them all. We ſhall therefore content our ſelves to know in general, that all the *Acids* have ſharp Angles on their Surface, without enquiring whether the Spirit of Sulphur, for example, has its parts Conical, Pyramidal, of many ſides, or otherwiſe.

As to the Structure of *Acids*; foraſmuch as it conſiſts in the ranging of the Particles of the *Æthereal Matter*, we need not doubt but that the Diverſity which is amongſt them in this reſpect, is almoſt Infinite. In effect, the ranging of theſe Particles depends upon their Magnitude, as well as on their Figure and their Motion.

Now there is an Infinite difference in the

Magnitude and Figure of the parts of the *Æthereal Matter*, and they move an infinite number of ways: There muſt therefore be an Infinite difference in the Structure of *Acids*.

Nevertheleſs, foraſmuch as hardneſs depends on the Structure, becauſe the more hard a Body is, it has the fewer Pores, or its Pores are the ſmaller, we may ſuppoſe that we know in general the Structure of *Acids*, is that they being the hardeſt of all the *Moleculæ*, they muſt have the feweſt Pores, or at leaſt ſuch as are the ſmalleſt. It ſhall ſatisfie us to know this, without troubling our ſelves to no purpoſe, to diſcover all the Modifications which may be in the Pores of *Acids*.

As to the Magnitude of their parts, the difference is alſo infinite; ſo that to conſider them in this reſpect, it is impoſſible to determine all the Diverſities. If we conſider in the mean time, that we find *Acids* whoſe parts are ſo ſubtil and ſo delicate that they are exhaled by a ſmall Fire; as for example, the parts of the Spirit of *Venus*, whilſt we find others ſo groſs and Maſſy, that they do not exhale but by the force of a vehement heat, ſuch as the Oyl of *Vitriol*, the Spirit of *Alum*, &c. we may well reduce, by this means, the *Acids* under two kinds, by dividing them into *Fixt* and *Volatile*. The *Fixt*, are thoſe which do not exhale, but by the force of a vehement Fire, and the *Volatiles* on the contrary ſhall be thoſe which exhale by a moderate heat.

SECT. III.

Of Alcali's.

SInce *Alcali's* are nothing but the moſt porous *Moleculæ*, to know them the better we need only examine their Figure, their Pores, and their Magnitude.

We may ſay here of *Alcali's*, what we have ſaid of *Acids* in ſpeaking of their Figure, *viz.* That they are ſo many, that it is impoſſible to know them all. The reaſon is, becauſe their compoſition depends upon the motion of the Particles of the *Æthereal Matter*.

For ſince theſe Particles move every way, they may in uniting themſelves compoſe *Moleculæ* of all ſorts of Figures, as well Regular as Irregular. So that the Underſtanding, finding it ſelf unable to examine them all, and wanting moreover means to accompliſh it, muſt content its ſelf to know that there are *Alcali's* of all ſorts of Figures without being ſollicitous to know the Figure of each *Alcali*.

It is convenient however to obſerve here that ſome *Alcali's* have the Figures of *Acids*; that is, that many *Alcali's* have ſharp Angles on their Surface. But becauſe they have not Solidity, they do not produce the ſame effect. In ſpeaking of the hardneſs of *Acids*, we have inſinuated that it depends upon the fewneſs or ſmallneſs of their Pores. Seeing then the *Alcali's* are incomparably more Porous than the *Acids*, they muſt of neceſſity have very little hardneſs in compariſon of the other, ſo that if ſome *Moleculæ* partake of an *Acid* becauſe of their ſharp Angles, and of an *Alcali*, becauſe of the great number and wideneſs of their Pores, they cannot produce the ſame effect which *Acids* produce, becauſe they have no Solidity, and in certain rencounters they have not the effect of *Alcali's*, becauſe of the ſharp Angles of their Surface. We ſhall call theſe ſorts of *Moleculæ*, *Alcaline Acid* Particles.

The Pores of *Alcali's* are alſo different from one another an infinite number of ways, which is the cauſe we cannot determine them; from hence it comes, that not being able to know in particular the Structure of the Pores of *Alcali's*, we ſhall content our ſelves to ſay, that they have the wideneſs and Figure that is needful to produce ſuch an effect, when we are to ſpeak of a Phænomenon that depends upon them, which will ſerve on the like occaſions.

As to the Magnitude of the *Alcaline parts*, tho' the Diverſities that are amongſt them be infinite, yet we ſhall divide them into Fixt and Volatile as we have done the *Acids*. With this exception, that the *Fixt Acids* do exhale by the action of a quick Fire, whereas the *Fixt Alcali's* do not exhale at all.

We diſtinguiſh therefore *Alcali's* into *Fixt* and *Volatile*; the *Fixt* are thoſe which ſubſiſt in the Fire, and change rather into Glaſs, than exhale. And the *Volatile* are thoſe which exhale by a moderate Fire; as for example, the *Spir.* of *Sal. Arm.* the *Volatile Alcal.* of Harts-horn.

SECT. IV.

Of the mixture of Acids *with* Alcali's.

After having treated of the *Acids* and *Alcali's*, we muſt mingle them together, to ſee what will follow; and that we may purſue a method that may give no occaſion of quarrel, we ſhall ſay nothing in this Chapter, which does not follow from what has been ſaid in the foregoing.

If we conſider that a pure *Alcali* is compoſed of nothing but the moſt *porous Moleculæ*, it muſt needs be granted that a great deal of the *Æthereal Matter* paſſes through the pores of its parts.

From hence it follows, that to the end a Body may ſubſiſt for a long time in the huddle of *Æthereal Matter*, the Pores which are on its Surface muſt be no greater than thoſe which are in the middle. The reaſon is, that if the Pores of the Surface were not a little near equal, the parts of the *Æthereal Matter*, which ſhould enter on one ſide, could not get out on the other with the ſame freedom as they entered. They would therefore force by their great agitation all that ſhould oppoſe their paſſage, and conſequently break the union of the parts; the meeting together whereof made the Pores too ſmall to permit them to paſs through them. Here recourſe cannot be had to the groſſer parts of the *Æthereal Matter*, which remaining on the Surface of the Body might keep its parts united, by reſiſting them uniformly with as much force as the *Æthereal Matter* that paſſes within: Becauſe all the parts of the *Æthereal Matter* which are leſs groſs than what runs through the parts of the Body, do not enter, and conſequently reſt on the Surface. But in as much as they have leſs force than what is within, they are obliged to give way, and let them at this place make all kind of havock, by diſordering all the parts of that Body, and breaking wholly the union of it. So that in that place where the Pores are narrower than in the reſt, there will never fail to follow a diſſolution of the parts.

This diſſolution or diſordering of the parts falls out ordinarily by the mixture of ſome Heterogeneous body, whoſe parts enter into the pores of its Surface ſtop them, and conſequently render them ſmaller. So that the *Æthereal Matter* not being able to get out at this place, as freely as it entered, forces the Obſtacle, diſorders the parts of this Body, and makes it paſſage, till it can continue its way through all with an equal facility.

When this motion which diſorders the parts of a Body is ſenſible, it is called *Fermentation*, and the Body by whoſe mixture it falls out, is called the *Ferment*. There are reckon'd five kinds of *Fermentation*. The firſt is called *Bubbling*. It is when the mixture of Bodies excites ſometimes a viſible motion of the parts, accompanied with ſmall Bubbles, and ſometimes ſmall Bubbles of Air only. Theſe Bubbles are produc'd by the detachment of ſome moſt delicate parts, which mingle with ſome parts of the Air, which is always to be met with amongſt the parts of Liquors. For in ſeparating, they ſcatter the other parts through which they paſs, and cauſe a ſufficient quantity of Air to be gathered together in theſe places, to make up a little Bubble, which by its Lightneſs aſcends to the Surface of the Liquor.

The ſecond is *Elevation*, which is when by the mixture of certain Bodies, the Bodies are blown up and ſwelled, or (to ſpeak more properly) rarified. Which is done when the diſſolution is not indeed ſenſible, but when the parts of the Diſſolvent are ſo figured that they cannot aſſociate with others without taking up together more place, than when they were ſeparated.

The third is *Sparkling*, which is when the mingled Bodies diſſolve with a kind of hiſſing, accompanied with ſmall and interrupted ſounds. Then the parts which are diſordered encline and bow by the action of the Ferment. Theſe parts thus bended, make a ſpring and excite thereby in the Air all thoſe little motions, which may produce in us the Senſation of Sound.

The fourth is *Effervescence*, which is done, to ſpeak properly, when by the mixture of Bodies there is made a diſſolution of parts, accompanied with ſome degree of heat. For if the diſſolution be not made but by a great effort of the *Æthereal Matter*, the motion which the parts acquire becomes great enough to excite in us the ſenſation of heat.

In fine, the fifth is *Exhalation*, which is done when the diſordering of the parts is accompanied with Fumes. Which falls out when by the diſorder, ſome ſubtile parts acquire motion enough to aſcend viſibly in the Air, whiles the more groſs parts remain in the Maſs.

After all theſe Reflections, it may eaſily appear that a *Fermentation* muſt follow upon the mixture of *Acids* with *Alcali's*: For *Acids* being pointed and *Alcali's* porous, if they be mingled together, the points of the *Acids* will enter into the Pores of the *Alcali's*, and render them conſequently ſmaller. So that the *Æthereal Matter* cannot get out at that place with the ſame facility that it enters. It will therefore diſorder the parts amongſt which the points of the *Acids* have been received, and this diſorder or fermentation will laſt till the *Æthereal Matter* can paſs through all with an equal facility.

Moreover according as the Pores of the *Alcali's* are great or ſmall, and the points of the *Acids* in compariſon of the *Alcali's* great or ſmall, the Fermentation will be a *Bubbling*, or an *Elevation*, or a *Hiſſing*, an *Efferveſcence* or *Exhalation*. Sometimes two of theſe kinds of *Fermentations* will be obſerved at once, as the *Hiſſing* and *Bubbling*, the *Exhalation* and *Efferveſcence*, &c. Sometimes three of them, ſometimes four, and ſometimes all of them. For according as the Pores of the *Alcali's* are a little more or leſs ſtopt by the Angles of the *Acids*, the *Æthereal Matter* will move with more or leſs force the parts of the Body which is Fermented. And it is from this greater or leſſer Agitation and Commotion that all the kinds of Fermentation derive their Origin.

From all this may be eaſily gathered that the *Fermentation* muſt laſt, when it is once begun, till the *Æthereal Matter* can paſs without hindrance through the Pores of the *Alcali's* which are mingled with the *Acids*. Which is done when the parts have been ſo diſordered, as that all the pores which were before formed, are deſtroyed, and others formed of a near equal wideneſs. For when things are brought to this State, the ſubtile matter meets no ſtop in its paſſage. Therefore it paſſes ſtraight forward without moving any part of the Body through whoſe Pores it paſſes.

When the parts of theſe *Alcali's* have been diſordered thus by *Acids*, they recover their firſt calm, and are ſo united with them, that there reſults from both a Body of a third ſpecies, which is neither *Acid* nor *Alcali*, but a compoſure of both, which we ſhall call a *Salt*. So that *Salts* are nothing but porous Bodies, whoſe Surface is made all rough by the points of the *Acids* which are faſtned to it.

There is no property obſerved in *Salt*, which is not a Conſequent of what we have ſaid, as we could demonſtrate, if we did treat here of Salt as it ought to be treated in Phyſick. But ſince we ſpeak of it only as a reſult of the mixture of *Alcali's* with *Acids*, we ſhall ſay only, that as there is an almoſt infinite diverſity of *Alcali's* and *Acids*, ſo there are ſo many differences to be found amongſt *Salts* that it is impoſſible to determine them all. Nevertheleſs it is fit to take notice that moſt of theſe differences depend upon *Acids*. For ſince *Salts* do not act on Bodies, but by the points of *Acids*, which are raiſed on the Surface of the *Alcali's*; all the difference which is to be met with in theſe properties, depends upon the Acid points, which act ſometimes one way, ſometimes another, as they are more or leſs ſharp, in a greater or leſſer number.

There are notwithſtanding *Salts* which differ amongſt themſelves by their *Alcali's*, as may eaſily appear by what we have above ſaid. For if a certain *Acid* be mingled with a *Volatile Alcali*, it is not to be doubted, but there reſults from this mixture a Salt, which will be different from the Salt reſulting from the mixture of the ſame *Acid* with a *Fixt Alcali*. For that the *Volatile Alcali's* have their parts incomparably more delicate than the *Fixt Alcali's*. From whence it follows, that the parts of the Salts muſt be alſo incomparably ſmaller, which ſuffices to make a difference between the Salts.

From what we have ſaid we may divide Salts into *Fixt* and *Volatile:* The *Fixt Salts* are thoſe which have their part ſo groſs, that they do not exhale with any heat, as *Sea Salt*, *Vitriol*, *Saltpetre*, &c. And *Volatile Salts* are thoſe which do exhale by a moderate heat, as the *Flowers* of *Sal Armoniack.*

SECT. V.

Of Sulphurs.

WE have ſaid nothing hitherto of the Figure, Structure and Magnitude of *Acids* and *Alcali's*, which may not as well be underſtood of the Figure, Structure and Magnitude of *Sulphurs.* In effect, if it be conſidered attentively, it will eaſily appear that there is an infinite diverſity of *Sulphurs*, by reaſon of their Figure. For if one *Sulphur* have parts more branched than another; if it have parts whoſe branches are ſhorter or longer, or otherwiſe ranged than another, it will be infallibly different, and conſequently capable of producing different effects. And foraſmuch as there may be amongſt all this an Infinity of Modifications, it ſeems to me moſt evident, that there may be alſo an Infinity of differences amongſt *Sulphurs* in reſpect of their Figure.

There is no leſs diverſity amongſt them in reſpect of their Structure. For ſince *Sulphurs* are made by the Collection of parts of the *Æthereal Matter*, ſince theſe parts may be collected an infinite number of ways, it is clear there may be of *Sulphurs* an infinite variety as to their Structure.

If further we conſider their Magnitude, we perceive there is no leſs difference amongſt them as to this. For ſince matter is diviſible *in infinitum*, there may be an Infinite difference amongſt the parts, ſome of which are groſſer than others, becauſe there is no Magnitude which may not be augmented, without acquiring in the mean time the Magnitude of another which is a little groſſer than it.

We cannot therefore, what Method ſoever we take, place *Sulphurs* under certain kinds, by conſidering ſimply their Figure, Structure or Magnitude. Nevertheleſs, ſince we have reduc'd *Acids* and *Alcali's* under two kinds, by dividing them into *Fixt* and *Volatile*; notwithſtanding the infinite difference there is amongſt their parts, we may do here the ſame thing as to the *Sulphurs*. And ſince there are *Sulphurs* which do not exhale but very difficultly, and others which exhale by moderate heat; we may be allowed to call the former *Fixt Sulphurs*, and the later *Volatile Sulphurs*.

The *Fixt Sulphurs* exhale very difficultly for that their parts are groſs, and ſurrounded with thick branches. For then as ſoon as they are agitated, they communicate almoſt all their motion, to the parts of the Bodies which environ them: So that they cannot acquire Matter ſufficient to exhale them without an extreme heat. Whereas the *Volatile Sulphurs* having their parts very delicate, and their Branches moſt ſubtile and cloſe, they move eaſily: And therefore a moderate heat can give them agitation ſufficient to raiſe them into an Exhalation.

SECT. VI.

Of the mixture of Sulphurs *with* Acids *and* Alcali's.

AFter having examined the nature of *Sulphurs*, it will not be amiſs to mingle them with thoſe Elements, whoſe nature we know, and ſee what will be the Iſſue.

Since *Acids* are *Moleculæ*, which have many *ſharp Angles* on their ſurface, and *Sulphurs* are *Moleculæ* branched; if we mingle an *Acid* with a *Sulphur*, the *Acid* muſt coagulate the *Sulphur*. When we mingle an *Acid* with a *Sulphur*, the *Acid* does in a manner mix its points amongſt the Branches of the *Sulphur*; by which means it holds the parts and gathers them ſo together, that by little and little they loſe their motion, and co-agulate. So it may well be ſaid in general, that *Acids* co-agulate *Sulphurs*.

If the nature of *Alcali's* be well conſidered, it will eaſily appear that they muſt act on *Sulphurs* in a way quite oppoſite to that of the *Acids*. For if *Acids* co-agulate *Sulphurs* by implicating their points in their Branches, the *Alcali's* which are without points muſt diſſolve them. When the *Alcali's* mingle with the *Sulphurs*, they do as it were ſeparate the parts, by placing themſelves amongſt them. They free them of one another, ſo that having no more union, the whole becomes more Liquid. And ſo it may well be ſaid in general, that *Alcali's* diſſolve *Sulphurs*.

SECT. VII.

Of Phlegm.

BEſides *Acids*, *Alcali's* and *Sulphurs*, there are alſo oblong and ſmooth *Moleculæ*, whoſe two ends are blunted, almoſt like the Extremities of an Egg. Theſe parts compoſe the *Phlegm* or Water, when they are gathered together in a conſiderable quantity.

The difference which may be amongſt

Phlegm, as to their Figure, is ſo ſmall, that it does not deſerve our Conſideration: For as they are all oblong and ſmooth, the more or leſs they are ſo, the more or leſs capable are they of producing Effects, and conſequently the differences may be great.

The ſame thing may be ſaid as to their Magnitude, which is never ſo different, as thereby to diſtinguiſh them into *Fixt* and *Volatile*. On the contrary, for that their parts are ſleek and oblong, they never intermix ſo ſtrongly with other Principles, but that a little motion will extricate them, and conſequently a very ſmall heat raiſe them into a Vapour. So that to conſider them, after this manner all *Phlegms* muſt be *Volatile*.

SECT. VIII.

Of the mixture of Phlegm *with* Acids, Alcali's, *and* Sulphurs.

SInce *Acids* are the moſt ſolid and moſt angulous *Moleculæ*, all that can befall them by the mixture of *Phlegm* is diſſolution. When we conſider that parts ſo Figured as to have many angles on their ſurface, when they are gathered together, do ſeldom touch but by the points of their angles; it will eaſily appear, that having ſo ſlender an union, a little force will ſhake them. And foraſmuch as the diſſolution of a Body is nothing but the diſorder of its parts, the *Phlegm* having ſufficient force to diſorder the parts, the *Acids* muſt be diſſolved.

Beſides the diſſolution of *Acids*, which is made by the mixture of *Phlegm*, their force is extremely weakned, which is not by the diviſion of their angles; but rather becauſe the *Phlegm*, which keeps the parts of the *Acids* diſtant one from another, has not the ſame force to act upon certain Bodies, that we obſerve to be in *Acids*.

All that we have ſaid of the mixture of *Phlegm* with *Acids*, muſt alſo be underſtood of the mixture of *Phlegm* with *Alcali*'s. For the ſame reaſon which has made us conclude that *Phlegms* diſſolve *Acids*, muſt make us ſuppoſe that they diſſolve *Alcali's*, yet it is true that *Phlegm* muſt diſſolve *Alcali's* with ſomewhat leſs trouble than they do *Acids*, for that the *Alcali's* being only porous parts, they touch them in more places than they do *Acids*: So that they require leſs force to diſorder them. Their diſſolution muſt alſo diminiſh their activity, by the ſame reaſon that the diſſolution of *Acids* by a mixture of *Phlegm*, does weaken their force. For if the parts of water cannot produce the ſame effect with the parts of *Acids*, neither can the ſame parts of water do the office of the *Alcali's.* The ſame thing undoubtedly may be ſaid of *Salts*, becauſe the *Saline Particles* not being joined together, but by the points of their *Acids*, they may be diſordered by the leaſt force, ſo that the *Phlegm* ſtriking againſt them, ſhakes and ſeparates them one from another with great eaſe. The *Phlegm* muſt alſo weaken the Salts after the ſame manner that they diminiſh the force of the *Acids* and the *Alcali's*.

But the *Phlegms* muſt produce on the *Sulphurs* an effect quite contrary to what they produce on the *Acids*, the *Alcali's* and the *Salts*: Becauſe the *Sulphurs* having their parts branched, their branches do ſo engage amongſt one another, that they do not leave between them *Interſtices* or *Spaces* large enough to give way to the parts of the *Phlegm*: So that the *Phlegms* not being able to thruſt themſelves in amongſt the parts of the *Sulphurs*, and moreover not being able to ſeparate the parts which cloſe one upon another, without explicating themſelves when they are encountered, inſtead of diſſolving them, they force them cloſer together. For the parts of the *Phlegm* ſtriking on all ſides the parts of the *Sulphurs*, without ſeparating them from one another; and not being able to enter into the pores which they leave between them, they preſs them, the one againſt the other, and in ſome manner encreaſe their union. Hence it is that Oyls do not mingle with water.

SECT. IX.

Of Earth.

WE have not only remarked *Acids*, *Alcali's*, *Sulphur*, and *Phlegm* amongſt the *Moleculæ* but we have found alſo a fifth kind of Particles, which is different from the reſt. Theſe are they which have not ſharp angles on their ſurface, but are rough and unequal; which have fewer pores than the *Alcali's*, and are leſs ſolid than the *Acids*; which have not the branches of the *Sulphurs*, nor the figure of the *Phlegm*; in a word, which have nothing peculiar, but a ſurface very unequal, with a very conſiderable ſolidity, which we call *Earth*.

When we conſider their Figure, Structure, and Magnitude, we can ſay nothing of them but what we have ſaid already of the Figure, Structure and Magnitude of *Acids*, *Alcali's*, and *Sulphurs*: And this has obliged us to diſtinguiſh them into *Fixt* and *Volatile*. So we find that there may be parts of *Earth* groſs enough to ſubſiſt in the Fire, which we call *Fixt Earth*; and there may be ſome alſo, which cannot ſubſiſt in the Fire, but do exhale by a moderate heat, and thoſe we call *Volatile Earth.*

SECT. X.

Of the mixture of the Earth *with the other* Elements.

IF we reflect on the nature of *Acids*, *Alcali's*, *Sulphurs*, *Phlegm* and *Earth*, we ſhall find no great Matter reſulting from the mixture of Earth with the reſt: For it cannot diſſolve them nor co-agulate them, nor excite in them any Fermentation. So that all that it does, is to trouble the purity of other Elements with which it is mixt, and conſequently to diminiſh their force. Nevertheleſs, as the moſt part of Bodies are compoſed of many of our Elements, and ſometimes of them all, the Earth is not intirely uſeleſs; ſince it finds a place amongſt the other Elements, and fills the ſpaces which they leave between them, and by this means renders the whole Body more ſolid and firm.

SECT. XI.

Of the manner of knowing the Elements *which enter into the Compoſition of particular Bodies.*

IT ſignifies nothing to know that there are *Acids*, *Alcali's*, *Sulphurs*, &c. we muſt know which of them are in particular Bodies. To come to the knowledge of this, we make uſe of *Chymiſtry*, becauſe it ſeparates the Elements one from another, and exhibits them as far as is poſſible in their Elementary purity.

It accompliſheth this by the means of Fire, which is an univerſal Diſſolvent. The Fire, by its great ſubtilty, enters into the pores of Bodies, and by its great agitation moves their parts and breaks their union. So that in continuing to agitate and diſunite them, thoſe which are moſt *Volatile* ſeparate from the reſt, and the more Fixt abide in the Fire. After which we ſeparate them from one another, by the mixture of ſome other Body; and in fine, collect them in their Elementary purity.

For example, if I would know of what principles a *Plant* is compoſed, I take a ſufficient quantity of it, beat it in a Mortar, and without any more adoe, put it in a Cucurbite. I place my Cucurbite on a Furnace, and afterwards put on the Cucurbite an Alembick; and to the Pipe of this Alembick, I put a Recipient. I give it Fire as it ought to have, which acting upon my Cucurbite, makes to aſcend by Vapour into the Alembick, all that is *Volatile* in the Plant. Ordinarily if it be an Odorous Plant, we find ſome drops of *Sulphur* which ſwim upon the Water. We call theſe *Sulphurs Eſſences*. Beſides theſe *Sulphurs*, which are known for ſuch, not only becauſe they eaſily kindle when they are caſt into the Fire, but becauſe *Acids* co-agulate them, and *Alcali's* diſſolve them. There are ſome *Acids*, or ſome *Volatile Alcali's*, which are diſſolved in the Water. We know them by means of the Fermentation which they excite, either with *Acids*, or with *Alcali's*. For if they ferment with *Alcali's*, we do not fail to conclude, that they are *Acids*; and if they ferment with *Acids*, we conclude they are *Alcali's*. Thus we diſcover that in the Plant there are *Phlegm*, *Volatile Sulphurs*, *Volatile Acids* or *Alcali's*.

After this, that we may know what there is of Fixt; I take what remains in the bottom of my Cucurbite, and expoſe it to the Fire; if it take flame, I conclude that in the Plant there are fixt *Sulphurs*, which could not aſcend by Diſtillation. Afterwards I reduce the whole to aſhes, and to know of what theſe aſhes are compoſed, I make a Lee of them.

The Water diſſolves all that there is of *Acid*, *Alcali* and of *Earth*. I paſs my diſſolution through Brown-paper, to the end I may have nothing but the *Salts*, *Acids*, or *Alcali's* diſſolved in Water. And the *Earth* being too groſs to paſs through the pores of the Paper, remains within, and then I ſee how much *Earth* enters into the Compoſition of the Plant. I take after this my diſſolution which I ſet upon the Fire. The Fire by its activity makes all the water to exhale, and what there is of fixt, remains in the bottom of the Veſſel. I examine it, and ſee if it be an *Alcali*, by mingling it with an *Acid*; or if it be an *Acid*, by mingling it with an *Alcali*, by the Fermentation which it will excite with the one or with the other. But if it do not ferment at all, neither with *Acids* nor with *Alcali's*, I conclude that it is fixt Salt.

Thus I know all the Elements which enter into the Compoſition of a *Plant*, and how we may operate almoſt upon all Terreſtrial Bodies, to extract their Elements. Chymiſtry is the only Science whereby we may know aright of what Bodies are compoſed.

The moſt part do not grant this, becauſe they imagine that the Fire acting upon Bodies changes all their parts; ſo that the divers Elements which we extract from Bodies by the help of Chymiſtry, were not there in their opinion, ſuch as they are when we extract them. But I have great reaſons to be of another Opinion: 1° Becauſe the Fire does not change *Acids* into *Alcali's*, nor *Alcali's* into *Sulphurs*. For though the Fire by its great agitation may produce ſome change in the parts of a Body; yet it is Inconceivable that it can change the Principles by deſpoiling them of their own Nature to cloath them with the nature of another. Thus therefore though it were even true, that the Fire ſhould produce ſome change in the parts of Bodies upon which we operate to extract their Elements; yet it is certain that what is extracted of *Alcali*, was there under the form of *Alcali*; what is extracted of *Acid*, was there under the form of *Acid*, &c.

But that which obliges me chiefly to think that the Fire makes no change in the Elements of Bodies which are extracted by Chymiſtry, is, that if we take the Spirit of *Salt* and mingle it with the Fixt *Alcali* of *Tartar*, we make a true Salt of it; and if we take the Spirit of *Nitre*, and mix it with the Salt of *Tartar*, we make a true *Nitre* of it. Nevertheleſs all Perſons skill'd in Chymiſtry, know very well that the Fire muſt be blown with an extreme violence to diſtil the Spirit of *Salt* and the Spirit of *Nitre*. So if the Fire ſhould produce any change in the Elements that are drawn from

Bodies by its means, it would be chiefly in the Diſtillation of the Spirit of *Salt* and Spirit of *Nitre*, where it muſt act with all its force.

Nevertheleſs, Experience makes appear that there is no change produced, and that the Spirit of *Salt* and Spirit of *Nitre* were ſuch in the *Salt* and in the *Nitre*, as they are when the Fire has ſeparated them from the other Element, with which they muſt be mingled to conſtitute the *Salt* and the *Nitre*; ſince we make a true *Salt* and a true *Nitre*, by mingling them with that other Element, which is the *Salt* of *Tartar*.

We are convinced by true Philoſophy, that Odours are nothing but the moſt ſubtil parts that proceed from Odorous Bodies, and ſpread in the Air by way of Exhalation. We are not ignorant likewiſe that it is from the different Magnitude and Figure of the parts, that all the diverſity of Odours does proceed. So that there muſt be a certain Magnitude and Figure in theſe parts to excite a particular Odour. And if it fall out that this Magnitude or Figure be changed, let the cauſe of the change be what it will the Odour which theſe parts ſhould excite after this in us would not be the ſame. But we extract by Chymiſtry the Odorous parts of Odoriferous Bodies, without making any change in them: Since they excite in us the ſame Odours which the Bodies do from whence they were extracted. Witneſs the Eſſence of *Roſemary*, *Gilly-flowers*, *Cinamon*, &c. from whence we may with reaſon conclude, that the Fire does not produce any changes in the Elements which are extracted from Bodies by the help of Chymiſtry.

And ſince many different Liquors are to be found in Animals, which are compoſed of divers Elements, we ſhall make uſe of Chymiſtry to ſeparate them from one another, and to examine them apart, that we may know the nature of each in particular. After this we ſhall eaſily ſee what may be their uſes in the animal Oeconomy, and what effects do depend upon them.

DISCOURSE II.

Of the Blood.

WHen I ſtrike a Lance into any outward part of a living Animal, I remark that there comes from the wound I have made a red Liquor, which I call Blood.

I imagine that it is very important to know the nature of it aright, for I find it ſo ſpread through all the Body, that there is no part which is not watered with it. Which obliges me to gather a little of it in a Veſſel and to know if it be not ſome of our Elements, or if it be not a Compoſition of them. I mingle it firſt with *Acids*; and I find that they co-agulate it, in ſuch a manner notwithſtanding that they co-agulate but a part of it, and what remains is very Liquid and Tranſparent, which we call *Seroſity*. In the ſecond place I take the Seroſity and mingle it with *Acids*, and I find that there is made by this mixture a little Fermentation.

From hence I conclude, that there are in the Blood much *Sulphur*, and ſome *Alcali*; that the *Sulphurs* are that which has been co-agulated by the *Acids*; and that the *Alcali's* are that which ferments with the *Acids*, which we mingled with the *Seroſity*.

I do not ſatisfy my ſelf with this, I take *Alcali's* and mingle them with the Blood, to confirm what I conjecture by ſome new Experiment: And it falls out that the Blood is extremely diſſolved by this mixture. And as I know that the effect of *Alcali's* on *Sulphurs* is Diſſolution, I am confirmed the more in the opinion I have, that in the Blood there is a great deal of *Sulphur*.

The ſmall Fermentation which the *Acids* have excited in the Seroſity, makes me think that there is in the Seroſity ſomething more than *Alcali's*; and by conſequence that there is through all the Blood ſome other Principle than *Sulphurs* and *Alcali's*. To know therefore the truth of the matter, I take a conſiderable quantity of Blood, I put it in a Cucurbite, I place my Cucurbite in a Furnace to diſtil ſome part of it by Sand. I adapt a Head to my Cucurbite, and to the Pipe of the Head I apply a Recipient. I take care to lute the Junctures well, and give it a little Fire at firſt, and augmenting it afterwards by degrees, I dry gently all the Blood which I had put in my Cucurbite.

Whilſt the Blood is thus drying, there ariſe ſome Vapours in the Alembick, which gathering in its concave Surface, run in drops of Water through the Pipe into the Recipient. I take this water and try it, by putting it on my Tongue. A little ſavour that it excites there, makes me judge that it is not pure *Phlegm*; I mingle *Alcali's* with it, and I remark no Fermentation. Which makes me think, that what is in this Water is not *Acid*. I mingle afterwards *Acids* with it, and I perceive by the light Fermentation that ariſes from this mixture, that there are *Alcaline* parts extremely *Volatile* mingled with much *Phlegm*.

I take out (after this) that which is dried in my Cucurbite, and I put it in a Retort, which I place on a Furnace proper for this Uſe. I give it Fire by degrees, and there comes out of my Retort a ſtinking Oyl, which is the *Sulphureous* part of the Blood. With the ſtinking Oyl there comes out a great quantity of whitiſh Particles, which ſtick to the neck of the Cornute, and to the concave Surface of the Recipient, as if it were a moſt delicate hoar Froſt.

I examine the ſtinking Oyl, by the mixture of *Acids* and *Alcali's*. The *Acids* co-agulate it, the *Alcali's* Liquify it, for which Reaſon I doubt not but it is a true *Sulphur*. I do the ſame with the whitiſh Particles, which I rub off from the neck of the Cornute, and the ſides of the Recipient, and I learn by the great Fermentation they make with *Acids*, that it is nothing but an *Alcali*, which riſing by a moderate heat, is very *Volatile*. I have therefore three *Volatile* Principles which compoſe the Blood, *viz.* A moſt conſiderable quantity of *Phlegm*, much of a *Volatile Sulphur*, and yet more of a *Volatile Alcali*. That I may know now what remains in the bottom of the Cornute, I put it in a Crucible, and Calcine it by a wheel Fire. There is ſome ſmall matter that yet Exhales. And in fine, after the whole have been well Calcin'd, I make a *Lixivium* of it, which I filter. I make a part of the Water to evaporate, which makes up the *Lixivium*. I put the reſt in a cool place, and there Chryſtallizes ſomewhat about my Veſſel n form of a *Salt*. I take

I take this *Salt* and mingle it with *Alcali's* and *Acids*. The *Alcali's* do not move it, but the *Acids* excite a Fermentation, yet leſs than what they do with the *Volatile Alcali* of Blood. Which makes me think that it is a *Fixt Alcali* with which there may be ſome *Acid* mingled.

After this, I obſerve there remains ſome Terreſtreity in the Paper through which I filtered the *Lixivium*, from whence I had extracted the *Fixt Alcali*. So that after having examin'd all, I find that the Blood is a Compoſure of *Volatile Alcali*, *Fixt Alcali*, *Volatile Sulphur*, *Phlegm*, *Earth*, and it may be ſome little *Acid* mingled with the *Fixt Alcali*. So that it abounds more in *Sulphur*, in *Volatile Alcali*, and in *Phlegm*, than in any other Principle. For there is little of *Fixt Salt*, and almoſt no Terreſtreity.

We may eaſily underſtand by this, the reaſon why through a Microſcope there are to be ſeen in the Blood many ſmall red Globules which ſwim in a Chryſtalline Liquor, while the Blood is put into ſmall Pipes of Glaſs. The *Sulphurs* which are more diſpoſed to keep themſelves united to one another, becauſe their branches are embarraſſed, do ſwim in a Liquor compos'd of *Phlegms* and *Alcali's*. The *Phlegms* by their motion preſs thoſe branched Particles one againſt another, and oblige them to form ſmall *Sulphureous* Globules, after the ſame manner that the Air makes the drops of water Sphærical. And the *Alcali's* make the ſmallneſs of theſe Globules and oblige the Sulphureous parts of the Blood to aſſemble in ſmall Bodies, by keeping them ſeparated one from another.

We ſee alſo the reaſon wherefore curdled Blood, after having been waſhed in cold water, ſeems all Fibrous: For cold water diſſolves the *Alcali's* and carries them away. Afterwards it aſſembles the *Sulphurs*, which fall down to the bottom of the Veſſel like a Glairous matter, compoſed of ſmall Fibres like Glue.

For the ſame reaſon alſo it is, that when Blood is put into hot water, as ſoon as it comes out of the Vein, there gathers about ſmall Rods held therein a Mucilaginous and Glairous ſubſtance. For the *Alcali's* ſpread through all the water with the *Sulphurs*, and ſtrike together againſt the Surface of the ſmall Rods. The *Alcali's* never fix to them, becauſe they have not proper Particles for it; but the *Sulphurs* inſinuate the Extremities of their Branches into the Pores of the Wood, which are opened by the heat of the Water: So that finding themſelves engaged, they continue fixed there, and the other *Sulphureous* parts of the Blood which ſwim in the Water join to the firſt, ſo that *in fine*, when the Water is become Cold, we find the *Sulphurs* of the Blood upon the Surface of the Rods, like to a Glair, or Mucilage.

DISCOURSE III.

Of the Glandules.

IF we follow the *Arteries* and the Veins, we find a great number of their Branches end at certain round Bodies involved in a moſt delicate Tunicle; from which Bodies there goes a Canal, and from thence flows a Liquor quite different from the Blood.

Anatomiſts call theſe round Bodies *Glandules.* There are three conſiderable things to be remarked in them. The firſt, that each *Glandule* receives a Branch of an *Artery*, which carries the Blood to it, and that there goes from it a Branch of a Vein which carries the Blood away. The ſecond, that there goes a Canal from each *Glandule* from whence flows a Liquor different from the Blood. And the third, that the Compoſition of *Glandules* is of two ſorts, ſome are nothing but a heap of ſmall Veſſels contorted, which reuniting, make the Canal through which there flows a particular Liquor. And others, are nothing but a meeting of little Veſicles. In ſome places theſe Veſicles are angular, and there is a Communication between their Cavities: So that they end all into two or three, whoſe prolongation makes the Canal, from whence flows the Liquor which is different from the Blood. In ſome others there are ſeparated Veſicles, which ſend out each one in Particular a little Canal. Thoſe, which are nothing but a heap of Contorted Veſſels we ſhall call *Vaſcular Glandules*, and thoſe which are compoſed of nothing but a heap of Veſicles, we ſhall name *Veſicular Glandules.*

If we conſider theſe three things deliberately, we will eaſily diſcover the nature of *Glandules.* The arteries bring the Blood, which after having watered the Veſſels or Veſicles of the *Glandules*, returns by the Veins which go from them. Now the *Glandules* are nothing but a Compoſure of ſmall Veſſels or Veſicles, full of a Liquor different from the Blood. But becauſe we have not hitherto diſcovered any Veſſel which brings any thing to the *Glandules*, but the Arteries which carry Blood thither, we may well think that this Liquor is a certain portion of Arterial Blood, which has been ſeparated from it by the Veſſels or Veſicles, and has been collected into their Cavity, from whence it comes that this Liquor flows always from the *Glandule* by the little Canal which comes from it, and which we ſhall call the *Excretory Canal.*

The difference that is between this Liquor and the Blood, ought not to keep us from being of this ſentiment. For ſince the Blood is compoſed of heterogeneous Principles, a certain portion of one, or many of theſe Principles, may be ſeparated from the Blood into the Cavity of the Veſſels or Veſicles of the *Glandules.* And ſeeing the principles of the Blood are not to be met with there, whether in number or proportion, ſufficient to make Blood, the Liquor that reſults from this Meeting, muſt be a Liquor quite different from Blood.

Thus the Liquor that flows from the *Glandules* by their Excretory Veſſels muſt come from the Blood. And that which confirms us yet more in this Opinion, is, that we can extract nothing from this Liquor by Chymiſtry, which we do not draw from Blood: which is a plain Evidence, that this Liquor is nothing but a Meeting of certain principles which have been ſeparated from the Blood, by means of the *Glandule.*

As to the Liquor which one *Glandule* ſeparates from the Blood, we obſerve that it is always the ſame. Neverthleſs, we muſt not for this imagine that all *Glandules* ſeparate the ſame Liquor. We find by Experience ſeveral very conſiderable differences between the Liquors which proceed from different *Glandules*: And this abundantly ſhews, that for the moſt part, that different *Glandules* draw different principles from the maſs of Blood.

But as this does not entirely ſatisfie the mind, it will not perhaps be impertinent to enquire into the manner, how the *Glandules* do ſeparate from the Blood, the Liquors which flow from them. The better to ſucceed in this enquiry, I ſhall obſerve that the *Arteries* bring the Blood into the Body of the *Glandule*, that the Blood is a Compoſure of heterogeneous parts, that ſome of theſe heterogeneous parts go out of the Cavity of the *Arteries*, and gather into the Cavity of the Veſſels or Veſicles, which compoſe the *Glandule*. From whence I conclude, that there are paſſages from the Cavity of the *Arteries* into the Cavity of the Veſſels or Veſicles of the *Glandules*, and ſuch Paſſages as that no other principle of the Blood can paſs thither, but theſe which are abſolutely neceſſary for making up the Liquor which flows from each *Glandule* in particular. We ſhall call theſe ſorts of Holes, or Paſſages, *Pores*.

To effect this, theſe Pores muſt be proportioned to the Magnitude and Figure of the parts which are ſeparated from the Blood, that they may be gathered into the Veſſels or

Veſicles of the *Glandules*, whilſt parts of another Magnitude and Figure cannot paſs through them: For then the Blood coming to run in the *Arteries*, which are ſpread through the ſubſtance of the Veſſels or Veſicles of the *Glandules*, ſuch of its parts as can paſs through the Pores, when they come thither are engaged in them. And becauſe the Blood continues to move in the *Arteries*, the parts which are engaged in the Pores through which they can paſs, are thruſt forward, and being followed by others which have the ſame fate, they are in fine preſs'd forward into the Cavity of the Veſſels or Veſicles of the *Glandules*. There they mingle with many others which are come thither after the ſame manner, and compoſe with them the Liquor which flows from the *Glandule* through its Excretory Veſſel.

But ſince the Liquor which runs from one *Glandule* is made up of Heterogeneous parts, it muſt needs follow that the *Pores* of each *Artery* are not all equal. So that according as the Liquor of one *Glandule* is compoſed of *Sulphurs*, *Alcali's*, or *Phlegms*, there muſt be proportionably in the *Arteries* of that *Glandule*, *Pores* fitted to let *Alcali's*, *Sulphurs* or *Phlegms* paſs through them.

We may affirm, That not only the *Pores* of the *Arteries* of the *Glandules* are not all equal amongſt themſelves; but alſo that thoſe of the *Arteries* of one *Glandule* are ſometimes entirely different from thoſe of the *Arteries* of another. The reaſon is, becauſe there comes ſometimes from one *Glandule* a Liquor entirely different from that which flows from another.

Hence it is to be obſerved, that there are *Glandules* to be met with alone, without being joined to any other. Theſe are called *Conglobated Glandules*, becauſe they are conſidered as little *Globes*, which ſeparate a Liquor from the Blood. But when there is a Meeting of them, and that they are all folded up within one Coat, and that all their Excretory Veſſels are united in one, and ſo compoſe one Canal through which the Liquor runs, which they have all with one accord ſeparated from the Blood, they are called *Conglomerated Glandules*.

The greateſt part of the *Conglomerated Glandules* are *Vaſcular*, and the moſt part of the *Conglobated* are *Veſicular*. As thoſe may ſee who will give themſelves the trouble to make the enquiry. Sometimes there are *Conglobated Glandules* which are *Vaſcular* in ſome Animals, and *Veſicular* in others.

DIS-

DISCOURSE IV.

Of the Nerves.

THE Covering of the *Brain* and of the *Cerebellum*, as well as the inner part of the Marrow of the Back-bone, are made up of nothing but a heap of ſmall round Bodies. It is obſerved that they receive *Arteries*, they ſend out Veins, and there goes from them a ſmall white *Fibre*. The *Arteries* do bring them Blood; after that it has watered them it returns by the Veins. But ſince it is not found in the Veins with the ſame qualities which it had in the *Arteries*, we may well conjecture that it has left ſomething in theſe round Bodies, which occaſions all this Change.

In ſhort, this Change does not befall the Blood, but either by the Addition of ſome new matter, or the loſs of ſome of its parts: It will eaſily appear that it is not from the addition of any new matter, if we conſider that theſe little round Bodies receive nothing but from the *Arteries*.

For if they made this alteration in the Blood by communicating unto it any new Liquor, they would receive it elſewhere. The reaſon is, becauſe the Blood paſſes continually through theſe round Bodies, and is alſo continually changed: So they muſt inceſſantly Communicate unto it this Liquor, which cannot be, if they do not receive it from ſome inexhauſtible ſource. Since therefore this ſource is not known, we may reaſonably conclude that this Change does not befall the Blood by the addition of any new matter.

It muſt needs then be occaſioned by the loſs of ſome of its parts. And becauſe this change is ſenſible, it muſt be by the loſs of a conſiderable number of its parts; which ſince they cannot ſtay in theſe round Bodies, becauſe they are perpetually parting from the Blood, they muſt needs go through ſome paſſage to be carried elſewhere.

When we examine narrowly theſe round Bodies, we find nothing in each of them, but *Arteries*, *Veins*, and a ſmall white *Fibre*. The parts which are ſeparated from the Blood, do not go by the *Artery*, ſince it is by the *Artery* that the Blood comes to the round Body; neither do they go by the *Vein*; for if ſo, there would be no difference between the Blood of the *Artery* and that of the *Vein*. It remains therefore, that they paſs through the ſmall white *Fibre*. And thus we find that the Covering of the Brain is nothing but a compoſure of ſmall *Glandules*, which do receive Blood from the *Arteries*, which ſend it off by the *Veins*, and which have their Excretory Veſſels

ſels from whence the Liquor flows, which they have ſeparated from the Blood.

There are two ſorts of Subſtance taken notice of in the Brain, the *Cerebellum* and the *Spinal Marrow*. The firſt is that Glandulous Subſtance, which compoſing the Covering of the Brain and *Cerebellum*, is called their *Cortical Subſtance*. In the *Spinal Marrow*, it is found in the middle covered with the other Subſtance. And the other, which is a white Subſtance, more firm than it, is nothing but the Collection of the Excretory Veſſels of the Glandulous Subſtance. They call it in the Brain and Cerebellum, the *Callous Body*, or the *Marrowy Subſtance*; and in the Back-bone it has no Name.

The Veſſels which compoſe the Callous *Body* of the Brain and *Cerebellum*, are ſo interwoven, that they reſemble a Net. It has not as yet been diſcovered, whether they are inſerted one into another, or whether the Nets be made only by their paſſing one over another.

In fine, they gather into little Bundles, which are found ſhut up into Membranous ſheaths. According as they advance into the Body of the Animal, they are divided into many ſmall branches, and after this manner ſpread themſelves all over the Body, ſo that there are very few parts in the Body of an

Animal, which do not receive their portion of them.

In the *Nerves* the Excretory Veſſels of which they are compoſed have no Communication; yet are obſerved to be interwoven. But they extend themſelves in length, one above another, as if they were ſmall Bundles of little Cords.

I ſay, this happens in the *Nerves*, but it may be obſerved that it is quite otherwiſe in certain Tumours faſtned to the *Nerves*, which are called *Olive* Bodies, or *Ganglions*. For theſe Olive Bodies are only formed by the interweaving of the Nervous Veſſels; juſt as the thread wherewith a ſling is made, ſeems to take up more room in the Body of the ſling where the Stone is plac'd, than in the ſtrings which are on either ſide.

Many *Nerves* meet together in divers places of the Body of an Animal, and are ſo interlaced one with another, that the Anatomiſts call theſe Meetings together *Plexus*. They part afterwards from theſe *Plexus*, and ſpread round about.

It muſt carefully be obſerved, that when many *Nerves* meet in one, there is not an Anaſtomoſis of the Veſſels that Compoſe them, but only of their Coats. And when a *Nerve* is divided into many branches, its particular Veſſels are not branched into many, but the di-

diviſion is only in their cover, and the Veſſels which are in one Bundle, are parted into many Bundles.

In fine, the uſe of the *Nerves* is to diſtribute the Liquor which runs into the *Fibres*, into all the parts where they terminate. As to this Liquor, it muſt needs be compoſed of the moſt ſubtile and moſt *Volatile* parts of the Blood. It is look'd upon as a very ſubtile wind which paſſes through the *Fibres* of the *Nerves*, and that not without reaſon. For ſince it eſcapes our eyes, and that we are not able to diſcern it by the help of the beſt Microſcopes we may well think that it is the moſt ſubtile of all the Liquors which are ſeparated from the Blood through the *Glandules* of the Body of an Animal. This Liquor is called the *Animal Spirits*, becauſe of its great ſubtilty, and becauſe it is the Soul, which makes Animals to live.

Though nothing of this Liquor can be gathered to examine its nature, by mingling it with *Acids* and *Alcali's*, yet we are enclined to think that the *Volatile Alcali* prevails in it with an extremely *Volatile Sulphur*. The reaſon is, becauſe all *Volatile Alcali's* taken inwardly, do encreaſe the Animal Spirits, the *Volatile Sulphurs* do almoſt the ſame thing, and there is nothing which does ſo much encreaſe their quantity, as *Sulphureous Volatile Alcali's*, *Alcali's*, as all *Volatile Alcali's* Aromatiz'd are.

The Effect of *Alcali's* upon *Sulphurs*, confirms us in this Opinion. For *Alcali's* do diſſolve *Sulphurs*, by ſeparating their parts one from another, and by this means hinder their branches from intermixing. For this cauſe the Interſtices or Intervals of the branches are repleniſh'd with *Æthereal matter*, as well as the Pores which remain between the *Sulphurs* and the *Alcali's*; which being larger than if the Liquor were ſimply *Alcaline* or *Sulphureous*, do alſo contain within them much more of *Æthereal matter*. And for as much as this *Æthereal matter* is highly agitated, it moves with much force all the parts of this Liquor, which contributes not a little to its activity and ſubtilty.

DISCOURSE V.

Of the Muſcles.

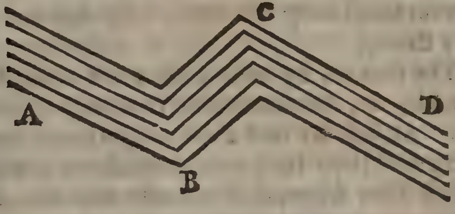
WHen we follow the *Nerves* and *Arteries*, we find that the moſt part of their branches do terminate in *Carnous Bodies*, which are covered over with a moſt delicate Membrane, and are called *Muſcles*.

The

They are compoſed of three parts: 1. We diſcover in them a great many *Arteries* and *Veins*. 2. *Nerves*; and 3. Small *Fibres*, which are neither *Arteries*, *Veins*, nor *Nerves*, but certain ſmall long *Filaments*, very fine and yet very ſtrong.

The manner by which they are ranked in the *Muſcles*, has ſomething in it very remarkable. At firſt we find them all gathered together, and then they reſemble a ſtring; afterwards they ſeparate from one another, and receive amongſt them divers branches of *Arteries* and *Veins:* At laſt they unite together, and make again a Cord. The firſt and ſecond Cords are called *Tendons*, or the *Head* and *Tail* of the *Muſcle*. And that part which is plac'd between the Head and the Tail, and which is the place where the *Fibres* of the *Tendons* ſeparate from one another, and where they receive the Veins and Arteries amongſt them, is called the *Belly* of the *Muſcle*.

Theſe *Fibres* are all parallel both in the *Tendons* and in the *Belly*. Some of the *Tendons* are longer than others, and in the *Belly* all are of the ſame length. By the order they are plac'd in, they make an *Obliquangular Parallelogram* in the *Belly* of the *Muſcle*. And they are ſo cloſely preſt together in the *Tendons*, that they reſemble two Strings; which draw the *Obliquangular Parallelogram* by its oppoſite ſides, as may be ſeen in this Figure.



A. B. repreſents a *Tendon*, or the head of a *Muſcle*, B C. the *Belly*, and C. D. the other *Tendon*, or the *Tail.*

The *Arteries* and *Veins* which are ſpread through the muſcle, are only to be found in its Belly; if they be found ſometimes in the *Tendons*, they are ſo few, that they are not to be regarded. So the *Tendons* are nothing but the Meeting together of the ſimple Fibres, which we therefore ſhall call the *Tendinous Fibres*; whereas the Interſtices, which are amongſt them in the Belly of the muſcle, are all repleniſh'd with *Veins* and *Arteries.*

Hence comes the difference, which we obſerve between the colour of the *Tendons* and that of the Belly of the Muſcles. The *Tendons* are Brown, and the Belly is Red. This is the part of Animals compoſed of *Tendinous Fibres*,

Fibres, *Veins* and *Arteries*, which we call *Fleſh*.

Therefore we muſt not imagine that *Fleſh* is Red of its ſelf, no more than we are to believe that a Glaſs, full of red Wine, is red of its ſelf. But rather as the Glaſs appears Red, becauſe the Liquor that is within it is of that colour, even ſo *Fleſh*, and all the other parts of the Body of an Animal, appear Red, only becauſe of the Redneſs of the Blood which is contain'd in the *Veins* and *Arteries* of theſe ſorts of parts.

This truth is demonſtrated by an Experiment which renders it Inconteſtable. That is, if you make Injections of warm water into the *Arteries*, which ſpread their Branches through the Fleſh, after you have repeated frequently the Injection, the *Fleſh* becomes of the colour of the *Tendons*.

The *Muſcles* are not only compoſed of *Arteries*, *Veins* and *Tendinous Fibres*, but the *Nerves* alſo make one of their parts. They march firſt upon their Coat and pierce it. When they have pierced it, they divide themſelves in moſt delicate Branches, which are inſerted into the *Tendinous Fibres*. Sometimes the *Nerves* enter into the *Tendons*, and ſometimes into the *Belly* of the *Muſcles*. But in what part ſoever they enter we find always the extremities of their Branches to end at the *Tendinous Fibres*.

All theſe *Tendinous Fibres* have a Cavity that goes through them, like unto a Tube or Pipe. Indeed this Cavity cannot be ſeen by the eye, but there is an Experiment which abundantly ſhews the neceſſity of it, that it cannot be contradicted by thoſe who will hearken to reaſon. The Experiment is, that always when a *Muſcle* acts, its *Fibres* are conſiderably ſhortned, and at the ſame time grow thicker. Neverthelefs we cannot conceive how flexible *Fibres* can grow bigger, and be ſhortned, at the ſame time, but by the means of ſome Liquor which fills a Cavity that pierces them from one end to the other.

After this it will not be very hard to diſcover how all theſe things muſt act. Each *Tendinous Fibre* receives a Branch of a *Nerve*; and each branch of a *Nerve* ſheds animal Spirits into the Cavity of the *Tendinous Fibre.* The Animal Spirits are the moſt ſubtil and the moſt agitated parts of the Blood. When they enter into the Cavity of the *Tendinous Fibres* they blow them up and ſhorten them. Even as the Air which is blown into a bladder, ſwells it and ſhortens it at the ſame time.

If we conſider after this, that the Belly of the *Muſcle* is ſtuff'd throughout with *Arteries* and *Veins*, we will grant that the *Tendinous Fibres* cannot be blown up without diminiſhing the Cavities of the *Arteries* and *Veins*;

from whence it follows that the Blood is driven out of them. It is for this Reaſon that in ſome Animals the *Muſcles* become white always when the Animal Spirits do dilate the *Tendinous Fibres.*

In fine, if we take notice that when the Blood ſtops in the *Arteries* and *Veins*, the *Tendinous Fibres* do not receive enough of motion from the Animal Spirits to thruſt forward that Blood which ſtays amongſt them; from hence it follows, that in ſuch rencounters they cannot dilate nor become ſhorter.

Hence we may conclude, that there are two things abſolutely neceſſary for the blowing up of the *Tendinous Fibres* of the *Muſcles*: the firſt is, that the *Animal Spirits* muſt have their free courſe through the *Nerve* which goes to the *Muſcle.* For ſince the *Tendinous Fibres* are not blown up but by them, it is clear, that if their courſe be ſo interrupted that they cannot flow into their Cavity, they cannot dilate them. Experience confirms this, in that if you cut or tie a *Nerve* with a thread, the *Muſcle* which receives branches from it, becomes flaccid, and do what you will its *Fibres* do not ſwell.

The ſecond thing needful for the blowing up of the *Fibres*, is the free courſe of the Blood through the *Arteries* and *Veins* of the *Muſcles*. For ſince the *Tendinous Fibres* cannot be dilated without ſtraitning the *Arteries* and *Veins*, and the *Arteries* and *Veins* cannot be ſtraitned without voiding the Blood that fills them, it is viſible that if the Blood ſtop there, it will hinder the *Tendinous Fibres* from being blown up.

This is ſo true, that if you take a living Animal and tie the *Aorta* four Fingers below the Heart, it becomes paralytick from the ligature even to the Extremities of the feet.

When the *Fibres* of a *Muſcle* are blown up by the Animal Spirits, there are two powers which concur to reſtore them to their firſt eſtate. The firſt is the ſpring which theſe *Fibres* make: For ſince their *Pores* acquire a diſpoſition by their being blown up, the Æthereal matter which does inceſſantly paſs through them, makes an effort to reſtore them to their former eſtate.

The ſecond is the Effort of the *Arterial Blood*, which being forcibly puſhed by the Heart, blows up again the *Arteries* and *Veins*, and at the ſame time ſtraitneth the *Tendinous Fibres*. And as the *Arteries* empty themſelves of Blood when they are ſtraitned by the ſwelling of the *Fibres*, ſo the *Fibres* empty themſelves of the Animal Spirits, when they are put again into their ordinary ſtate, as well by the force of the *Arterial Blood*, as by that of their Spungineſs.

As to the reſt, the *Tendons* of the *Muſcles* are ordinarily faſtned to ſome *Cartilage*, or to ſome bone. Which is the Cauſe why the ſhortning of the *Tendinous Fibres* makes that part move to which the Tendons are faſtned. It is to be remarked likewiſe, that one of the Tendons is faſtned to an immoveable part, and the other to a moveable part; from whence it follows, that when the *Muſcle* is ſhortned the moveable part is drawn towards the immoveable.

But for as much as there is ſcarce any motion in one part which has not its oppoſite motion, ſo there is ſcarce any Muſcle which has not its oppoſite Muſcle. Theſe Muſcles which ſerve thus to make oppoſite Motions, are called *Antagoniſts*.

It is to be obſerved, as to the Antagoniſt Muſcles, that when the one is ſhortned, the other is extended. For ſince their action is oppoſite, and that that of the one cannot ſubſiſt at the ſame time with that of the other, the ſhortning of the Muſcle which acts, muſt needs produce the extending of its Antagoniſt.

But for that the ſhortning of one Muſcle draws the Fibres of its Antagoniſt beyond their ordinary length, they muſt needs ſpring back. It is for this reaſon that the action of one Muſcle which has been lengthned by the contracting of its Antagoniſt, is done with eaſe enough.

For the Tendinous Fibres can be eaſily contracted again, however they have been lengthned, though there be few Animal Spirits which flow into their Cavity, becauſe the force of the Spirits is augmented by that of the ſpungineſs of the Fibre.

DISCOURSE VI.

Of the Cartilages, Bones *and* Membranes.

WE find in the Body of an Animal many parts which ſeem to partake of the nature of a Bone, and of the nature of Tendons, in that they are not altogether ſo hard as the former, and are leſs ſoft than the other. They call them *Cartilages.*

The firſt thing which makes me conjecture that Cartilages are nothing but a compoſure of Tendinous Fibres which are hardned by being repleniſh'd with Volatile *Alcali's*, is, that there is no Cartilage in which many Tendinous Fibres are not loſt. That which makes my conjecture probable, is, that we ſee plainly that the ſubſtance of the Cartilages is nothing but a heap of Fibres. And that which puts the thing out of doubt, is, that in young Animals many parts which were Tendinous become at length Cartilaginous; and that we

obſerve

obſerve frequently in old Animals, that certain Tendons are chang'd into Cartilages.

As Tendons are chang'd at length into Cartilages, the Cartilages are likewiſe changed into Bones. If therefore we have concluded the Cartilages to be nothing but a compoſure of Tendinous Fibres, becauſe the Tendons are ſometimes chang'd into Cartilages; we are obliged by the ſame reaſon to judge that Bones are nothing but a Compoſure of Tendinous Fibres, which after having been hardned to become Cartilages, are afterwards ſo far hardned as to make Bones.

The Obſervations which are made upon the Bones of *Fœtus's* do give us an ocular Demonſtration of this Truth. In ſhort, we obſerve there are a great many Tendinous Fibres, and particularly in the Scull. It appears in the beginning, as if it were nothing but a Membrane compos'd of Tendinous Fibres. It becomes afterwards Cartilaginous, and in fine is chang'd entirely into Bone. After which it cannot be doubted, but that Bones are a heap of Tendinous Fibres, which are hardned after ſuch a manner, that they acquire the firmneſs of Bone.

Tendinous Fibres are hardned, by being repleniſh'd at length with *Volatile Alcali's*. The Fibres of the Nerves do ſhed into their Cavity Animal Spirits. That which is more ſubtile of them, eſcapes by the Pores, and the groſſer remains. So that at firſt theſe Fibres are filled with *Volatile Alcali's* and *Volatile Sulphurs.* Whilſt there are Sulphurs there, they appear under the form of a Cartilage; but when the Sulphurs are conſumed, whether by nouriſhing the Fibres, or by eſcaping through the Pores, or in ſplitting themſelves, they appear under the form of Bones.

From hence it comes that there are no parts in the whole Body of an Animal, from whence we extract ſo much of *Volatile Alcali's* as from Bones.

In fine, we remark that Bones are all covered over with a Membrane, which they call the *Perioſteum.* This Membrane is ſo ſtrongly faſtned to the Bone, that in certain places it is impoſſible to ſeparate it, but by cutting or renting of it.

When we do examine it narrowly, we find three ſorts of parts which enter into its compoſition; to wit, a great many Tendinous Fibres, many branches of Nerves, and ſome Arteries and Veins. So that after we have duly conſidered all, we find that the *Perioſteum* is nothing elſe but a Web of Tendinous Fibres of the Bone, Nerves, Veins and Arteries.

And becauſe all the other Membranes have communication with the Bones and with the Tendons of Muſcles, and becauſe they have

Tendinous Fibres, Nerves, Arteries and Veins, we judge that all the Membranes which are obſerved in a living Body, are nothing but a Texture of Tendinous Fibres, Arteries, Veins and Nerves.

DISCOURSE VII.

Of the Lymphatick Veſſels, *and of the* Lympha.

IT is found that from all the Parts of an Animal, certain ſmall Veſſels do proceed, which Anatomiſts call *Lymphatick*, becauſe they are full of a clear and tranſparent Liquor, which they name *Lympha.*

The Membranes which compoſe them are ſo delicate, that they are inviſible when they are not repleniſh'd. They are inoculated into one another, and ſo compoſe pretty large Trunks, which are inſerted into the Veins.

Thoſe which come from the Head, and Neck, are inſerted into the Subclavian, or the Jugulars. And the moſt part of thoſe which derive their Origin from the Inferiour parts, and the *Viſcera* of the lower Belly, do diſcharge themſelves into one Ciſtern placed upon the *Vertebræ* of the Loins, from whence there goes a Veſſel, which after having paſſed over the *Vertebræ* of the *Thorax*, empties its *Lympha* into the Subclavian Vein.

This Ciſtern is called the *Reſervatory* of the *Chyle*, becauſe the Chyle, which is formed in the Stomach by the Digeſtion of the Meat, comes thither, and the Veſſel which goes from this Reſervatory is called *Canalis Thoracicus*, becauſe it is found upon the *Vertebræ* of the *Thorax*.

That which is moſt remarkable in theſe Veſſels, is a great quantity of little Valves, which are placed at very ſmall diſtances from one another. They are ſo diſpoſed as that they permit the *Lympha* eaſily to run towards the Veins, but they hinder it from coming back again, and from flowing towards the parts from whence the Lymphatick Veſſels do proceed.

From whence we may certainly conclude that the *Lympha* does not come from the Veins but from the parts from whence the Lymphatick Veſſels do derive their Origin: Which agrees exactly with experience; for if you tie with a thread any Lymphatick Veſſel, the *Lympha* does ſo abound between the Ligature and the part from whence the Veſſel comes, that it blows it up prodigiouſly; and is ſo emptied between the Ligature and the Veins whither it is going to diſcharge it ſelf, that there it becomes inviſible: From whence it follows that the uſe of the Lymphatick Veſſels is, to carry into the Veins the *Lympha* which they have received from all the parts of the living Body.

We have not hitherto diſcovered any Veſſel which brings any thing to the parts of the living Body, but Arteries and Nerves. The Arteries bring Blood and the Nerves Animal Spirits. It muſt needs therefore follow, that the *Lympha* comes either from the Arteries alone, or from the Nerves alone, or from the Arteries and Nerves together. It does not ſeem to come from the Arteries alone; for if you cut the Nerves which go to one part, there does not flow ſo much *Lympha* in the beginning, and diminiſhing by little and little, in fine, it ceaſes entirely. Neither does it come from the Nerves alone, ſince if you tie the Arteries which carry the Blood to one part, it ceaſes by little and little to furniſh *Lympha*. It muſt needs be therefore that the *Lympha* comes partly from the Arteries, and partly from the Nerves. And conſequently it muſt be compoſed of a part of the Arterial Blood and of the Animal Spirits.

The Lymphatick Parts which come from the Blood, paſs after the ſame manner, as the particles of the Liquors which flow from the Glandules. For as theſe paſs from the Blood by ſticking in certain Pores of the Arteries, even ſo the Lymphatick particles finding in the Arteries ſmall Holes through which they may paſs, they ſtick in them: But becauſe they are followed by others which preſs them forwards, they get out and paſs into the Fibres of the parts from whence the Lymphatick Veſſels come.

Thoſe which come from the Nerves do not get out this way. The Nerves inſert their Filaments into the Tendinous Fibres of one part, and ſend out the Animal Spirits into their Cavity. The Fibres have Pores through which they eſcape, and mingle themſelves with what runs from the Arteries, to compoſe the *Lympha* by their mixture.

Since we have prov'd in the diſcourſe of Nerves that the Animal Spirits are nothing but a Sulphureous *Alcali*, we may well ſuppoſe that the *Lympha* is nothing but a Compoſure of Volatile *Sulphurs*, Volatile *Alcali's*, and a little *Phlegm*. The Volatile *Sulphurs*, and Volatile *Alcali's* are the Animal Spirits which enter into its compoſition; and the *Phlegm* with the fixt *Sulphurs* are thoſe of its parts which come from the Blood by the Pores of the Arteries.

Unerring experience confirms this Opinion. That is, if you gather of the *Lympha* in a Silver Spoon, and place the Spoon on the Fire, as ſoon as it begins to warm, there goes from the *Lympha* a ſmall Vapour, and then it hardens like the white of an Egg that is boil'd.

I ſay this Experiment confirms, that the *Lympha* is nothing but a Compoſure of a great deal of Fixt *Sulphur*, a little of Volatile, a little of *Phlegm* and much Volatile *Alcali.* For the *Lympha* is fluid whilſt the Volatile *Alcali's* keep its *Sulphurs* diſſolved, and it hardens like the white of an Egg, as ſoon as the Fire has exhal'd them. For then the Fixt *Sulphurs* being alone, do ſo entangle their branches one with another, that they cannot move ſo as to compoſe a Liquor. As to the Volatile *Sulphur* and the *Phlegm*, it cannot be denied but there are ſome of them in the *Lympha*; becauſe the Animal Spirits which compoſe a part of it, are made up of them, and the Vapours going from the *Lympha*, when ſet on the Fire, do ſufficiently reſemble the Vapours of Water.

We conclude from this, that the uſe of the *Lympha* is to nouriſh the parts, between whoſe Fibres it paſſes. As will appear moſt plain when what we are going to ſay of Nutrition ſhall be conſider'd.

It is an Indiſputable truth, that many Particles of our Bodies are ſeparated and do exhale; and becauſe theſe parts paſs through the Pores of the Skin, like Wind imperceptibly, they call this *Tranſpiration*.

The parts which paſs from our Bodies by Tranſpiration, are ordinarily Salts diſſolved in Phlegms, with which there are ſome Sulphurs mingled. They are ſeparated from the Blood by the means of an infinite number of ſmall Glandules, which are ſituated under the Skin, and whoſe excretory Veſſels end at ſmall Holes, which are on the Surface of the Body, and which we call Pores.

Theſe Glandules which we ſhall call Subcutaneous, do receive Arteries, ſend forth Veins, and have ſome Filaments of Nerves. So that judging of them by others, we may well ſuppoſe their uſe is, to ſeparate the ſaline parts from the Maſs of Blood, which are formed there by the Conjunction of the *Acids* and *Alcali's*. Whence I conclude, that the parts which paſs away by Tranſpiration, are parts of the Humours of the living Body, and not Particles of its ſolid parts.

The *Acids* which are mingled with the Humours paſs away, not only when they are join'd with the *Alcali's*, but alſo when they are join'd to the Sulphurs. The Author of the *Animal Oeconomy*, has put a conſiderable number of Glandules in the Membrane, which cover the thin Leaves of Bone in the Noſe, which are proper to ſeparate from the Blood the Sulphurs united with *Acids*: And this is the reaſon that there runs from the Noſtrils a Glewy and whitiſh Liquor.

By this we ſee after what manner the *Alcali's*, *Sulphurs* and *Phlegms* of our Humours are conſum'd. Which makes me think that they would be very ſoon ſpent entirely, if they were not repair'd. And it is this reparation of the Humours which we call *Nutrition.*

The Animal Body is never better nouriſh'd, than when all its parts are full of Humours which Circulate, or are in motion. And becauſe it is the *Lympha* which flows amongſt the Fibres of the ſolid parts and fills up their Interſtices, it is this alſo which is that Humour whoſe abundance makes Nouriſhment.

DISCOURSE VIII.

Of the Mouth.

THE Mouth in all Animals is a certain hollow place in the head, through which Nouriſhment is conveyed to the Body. In which four principal things are taken notice of; namely, the Teeth, the Palate, the Spittle and the Tongue.

But before we begin to enquire into theſe things, it will not be impertinent to obſerve, that the Mouth is made by the upper and under jaws. The moſt part of Animals open the Mouth by putting down the nether Jaw, and they ſhut it by taking it up. The contrary is obſerved in Crocodiles, Serpents, and Lizards.

The ſides of the Jaws are pierced with many Holes of a conſiderable depth. They receive into their Cavities the roots of thoſe little Bones, which are more ſmooth, white and hard than others, which adorn the entry of the Mouth like to a Palliſade, and are called *Teeth*.

That part of the Teeth which enters into the Holes of the Jaws, is called their *Root*, and that which ſtands out is more particularly nam'd the *Teeth*. The Roots are uſually much longer than the Teeth themſelves, which is the Cauſe they ſtick ſo faſt in the Jaws.

Some have three Roots or points, others two, and many of them but one. When we break the Teeth with a Hammer, we find in the Body of them a hollowneſs, which extends its ſelf to the very Root.

The Teeth are not only fixt to the Jaws by their Root, but they are likewiſe faſtned to them by a hard and firm Fleſh which covers their ſides, and whoſe Fibres are extended from one end of the Jaws to the other. This Fleſh is called the *Gums*.

Moreover the Teeth are of three ſorts. Thoſe which are plac'd in the entry of the Mouth are broad, and their extremities made with an edge. They are called *Dentes Inciſivi*. The other which are farther within the Mouth, and which the Cheeks cover have a thick, ſtrong and large Body, and their extremities broad and unequal, which makes them fit to break and bruiſe; whence they are called *Dentes Molares*, or the *Grinders*. And there are yet others which are very ſtrong, and have their Extremities pointed, and are moſt fit to hold any thing faſt. There is always one of them placed on each ſide, between the *Inciſivi* and the *Grinders*, and they are called the *Dog-Teeth* or *Eye-Teeth*, becauſe they receive a branch of a Nerve from the Optick Nerves.

The Number of the Teeth is not always the ſame. Some men have 14 in each Jaw, ſome have 15, and others 16. Uſually they reckon four Inciſive, two Dog-Teeth, and eight Grinders, as well in the upper as the nether Jaw.

The uſe of the Teeth is to chew the Food. The Inciſive cut it into little Morſels, and the Grinders break and bruiſe it very ſmall, to the end it may paſs forwards, and the Dog-Teeth cut it in pieces, when the Inciſive are not ſtrong enough to do it.

The Palate is that part of the Mouth which makes its Roof, and which is extended from the upper Jaw-bone even to the bottom of the

Mouth. The ſurface of it is unequal, and its Fore-part cut into ſmall narrow furrows, plac'd near one another, from the Inciſive Teeth to the middle of the Mouth, and its hinder part is of a pretty even Surface.

It is furniſh'd outwardly with a very delicate Coat under which there is another more thick and ſtrong. When this is raiſed we diſcover an almoſt infinite number of ſmall Glandules. Theſe, being form'd like the ſtones of Raiſins make up the Body of the furrows of the Palate. Their Excretory Veſſels do pierce the Membrane which covers the Membrane which covers the furrows, and ſhed into the Mouth a pretty clear and ſomewhat viſcous Liquor. The hinder part of the Palate, whoſe Surface is even, hath under its Membranes ſmall Glandules of the bigneſs of Millet ſeed. They differ from thoſe which make the furrows of the Fore-part in this, that they are not ranked about their Excretory Veſſels, as the ſtones of Raiſins about the ſtalk of the Grape: but they pierce the Membranes of the Palate by as many Excretory Veſſels, as there are Glandules. All theſe Glandules of the Palate receive Arteries from the *Carotides*, ſend Veins to the external Jugulars, and receive Filaments of Nerves from the Seventh Pair.

We find at the bottom of the Palate three
remark-

remarkable Bodies, to wit, two Glandules, on each ſide one. They call them the *Almonds*; and between theſe Glandules a ſmall piece of Fleſh of a Conical Figure, which they call the *Uvula.*

The Almonds are Veſicular Glandules of a Yellowiſh colour. Though they ſeem two in number, yet they are but one, the middle of which is covered by the Membrane of the Palate, and the Extremities appear like two Lobes. This middle part which makes the Communication of the two Lobes, is both more ſtrait and more delicate, than the two ends of this Glandule.

Each Lobe has a *Sinus* or Cavity, which is divided in many Apartments, the Excretory Veſſels of theſe ſmall Veſicles tend thither, and ſhed a glewy and whitiſh Humour, which is not unlike to the Snot of the Noſe. They receive Arteries from the *Vertebræ*, they ſend Veins to the Jugulars, and their Nerves come from the third, fourth, and fifth Pair.

As for the *Uvula*, it is nothing but a ſmall bag of the Membrane of the Palate. It hangs between the two Lobes, which make the Almonds. This Bag is full of an infinite number of ſmall Veſicular Glandules, which are of the colour of the Fleſh, becauſe of the great number of Arteries which they receive from the *Vertebræ* and the *Carotides*, and the many

Veins which they ſend to the Jugulars. Their Excretory Veſſels do pierce on all ſides its outward Membrane, and wet it with a Tranſparent and ſomewhat viſcous Liquor.

The Mouth is not only watered with the Liquor which flows from the Glandules of the Palate and the *Uvula*, but there are likewiſe four other great ſtreams which empty themſelves into it. They diſcharge themſelves of a ſweet and Tranſparent Water, in which there is ſome Viſcoſity remarkable. This Liquor is called the *Spittle.*

We find within the Mouth two ſmall Holes, the one on the Right, the other on the Left ſide. They pierce the Cheeks towards the Molar Teeth, or Grinders: And becauſe we find them always wet, we make no doubt but they are the opening of two ſtreams of Spittle.

And if we put a Bodkin into them, we find that it eaſily paſſes into a ſmall Membranous Pipe, which extends it ſelf along the Cheeks, and is divided into many ſmall Branches when it comes under the Ear. This Veſſel is always found full of Spittle, and the ſmall Branches which are at the root of it loſe themſelves in a heap of Vaſcular Glandules. Theſe Glandules are placed about the Inner-part of the Ear, and are called *Parotides.* So that the ſmall Excretory Veſſels which go from each Glandule, coming to be inſerted one into another,

ther, make up Veſſels ſomewhat larger. Theſe larger Veſſels joining together compoſe a greater, which encreaſeth according as it approacheth nearer the Mouth, where it empties the Spittle which the *Parotides* have ſeparated from the Blood.

Moreover the *Parotides* receive their Arteries from the *Carotides*, and ſend Veins to the External Jugulars; there are amongſt them many Branches of Nerves which come from the hard Part of the Seventh Pair.

The opening of the other two ſtreams which diſcharge the Spittle into the Mouth, is to be ſeen under the point of the Tongue towards the Inciſive Teeth. They are ſo ſmall that they cannot admit a Hog's Briſtle. They appear at the end of two fleſhy *Papillæ*, which ſerve them for ſmall Sphincters. They extend themſelves along the Tongue, and when they come near its root, they are divided into many Branches which loſe themſelves in a heap of Glandules, which are called the *Maxillar Glandules*.

They are placed within the under-Jaw, and extend themſelves from the root of the Tongue as far as the Chin. The part of this Conglomerated Glandule which comes neareſt the *Parotides*, is groſſer and more red than the reſt. As it advanceth towards the Chin, it diminiſheth, ſo that it becomes by little and little more narrow and ſlender. There is obſerved towards its middle part a little compreſſion, which joins its fore-part to the hinder. And afterwards, after having encreaſed conſiderably, it extends its ſelf as far as the Chin in the Form of a Quince.

All the Glandules which compoſe it are nothing but a Complication of Veſſels which are inſerted into one another, and make by their Concourſe two conſiderable Canals. Theſe Canals extend themſelves on each ſide, along the Tongue, and end at the two *Papillæ* faſtned to the Gums, near the two Inciſive Teeth, within the Mouth.

The Maxillar Glandules receive their Arteries from the *Carotides*, and ſend Veins to the Jugulars: Their Nerves come chiefly from the third, fourth, and ſeventh Pair. They ſeparate the Spittle from the Blood, and the Veſſels, of which we have been ſpeaking, empty it into the Mouth.

Beſides the four ſtreams of ſpittle, we obſerve alſo many ſmall Rivulets of it within the under Lip, and along the Gum on the inſide the Mouth. It comes from ſome Glandules latent amongſt the Carneous Fibres of theſe parts, and whoſe Excretory Veſſels pour into the Mouth the Liquor which they have ſeparated from the Blood.

The little Viſcoſity that is obſerved in the Spittle, makes us imagine it is compoſed of ſome *Sulphurs*, ſome *Acids*, and much *Phlegm*, mixt with ſome *Salt*. It mingles with Victuals in the Mouth, and facilitates the Chewing by Moiſtning of them. It renders them more fluid, and by conſequence fitter to convey through the Paſſages which muſt carry them elſewhere. It may be ſaid alſo that by its *Acids* and *Salts*, it opens their ſmall parts and makes the beginning of a diſſolution. By the wonderful Foreſight of the Author of the *Animal Oeconomy*, the *Sulphurs* are made to incloſe the *Acids* to the end they may not corrode the parts which muſt be watered with Spittle.

The neceſſity of the mixture of Spittle with the Victuals appears in that all parts concur to the making of it. The Victuals preſs the Palate, and ſo oblige the Spittle, which its Glandules contain, to run into the Mouth, by the little Excretory Veſſels, which pierce its Membrane. The *Crotaphite Muſcle* and the *Maſſeters*, by ſtraitning and dilating themſelves preſs the *Parotides*, and through their Veſſels make two little ſtreams of Spittle to run which enter on the right and left Side into the Mouth. The *Digaſtrick* by its contraction and dilatation agitates the Maxillar Glandules, and preſſes the Spittle out of them, which runs through their Excretory Veſſels like two little ſtreams, which diſcharge themſelves into the Mouth. And ſeeing in the time of chewing all theſe parts act at once as is ſaid before, it muſt needs be granted that this mixture of the Spittle with the Victuals is moſt neceſſary.

In the laſt place the Tongue comes to be examined, which is a piece of Fleſh almoſt of a Conical Figure. Its Root is faſtned to the furtheſt part of the Mouth by a little Bone which is called *Os Hyoides:* And from the Root as far as the middle it is faſtned by its under-part to the Muſcles, which fill the Cavity of the Under-Jaw; but its point is free, and does not cleave to any part.

Under the free part of the Tongue there is a ſmall Line compoſed of ſmall Tendinous Fibres, which reach from one end, as far as the place where the Tongue diſingages it ſelf from the parts which fill the Cavity of the Under-Jaw. This ſmall Line is called the *Bridle.*

The *Os Hyoides* is plac'd in the further part of the Mouth at the Root of the Tongue. It is in form like a Fork extended, whoſe Arms cleave to a heap of Cartilages, called the *Larynx.* It is compoſed of many little Bones, which are join'd by Cartilaginous knots. Sometimes there are but three of them, and at other times they reckon thirteen, ſix on each ſide. As for the Bone in the midſt to which the Tongue is faſtned, it is large in Compariſon with the reſt, which are very ſlender. It is likewiſe ſomewhat broad, riſing towards the Tongue and hollow towards the *Larynx*. On its raiſed ſide it has two ſmall appendages which are ordinarily Cartilaginous. They call them the *Horns* of the *Os Hyoides.*

There are five pair of Muſcles which make it move with the Tongue. The firſt is the *Geniohyoidæus* which has its riſe from within the Chin, and reaches to the Root of the *Os Hyoides.* Theſe Muſcles ſerve to raiſe it by the ſhortning of their Fibres. The ſecond is the *Sternohyoidæus.* It comes from the top of the *Sternum*, aſcends along the *Arteria Trachæa*, and is faſtned to the Root of the *Os Hyoides.* This pair of Muſcles draws it downwards. The third is the *Milohyoidæus:* It ariſes from within the Under-Jaw towards the Hammers, and is inſerted into the Root of the *Os Hyoides*, which draws it up taking it by the ſides. The fourth pair is the *Coracohyoidæus.* It comes from the *Coracoide Apophyſis* of the *Homoplate.* Theſe have two Bellies, and are inſerted into the Horns of the *Os Hyoides*, which they draw downwards, taking it by the ſides. The fifth is the *Stylo-Ceratohyoidæus*, it ariſeth from the *Apophyſis Styloides*, and is inſerted into the Horns of the *Os Hyoides:* Theſe Muſcles reſtore it to its ordinary Situation, when it has been mov'd by others. They are pierced to give paſſage to the *Digaſtrique.*

As for the Tongue, it is covered with an outer Membrane, or Cuticula. We find under it a ſort of viſcous Subſtance. It is moderately thick, white on the ſide that touches the outer Membrane, and black on the other. It is call'd the *Reticular Body.* This Reticular Body is perforated like a Sieve, and there ariſe from each of its Holes ſmall Conical Bodies of an indifferent hard Subſtance. They appear in an extraordinary manner on the Tongues of Cats. They are very long and crooked towards the point of the Tongue, like ſo many little Horns. We find them alſo on the Tongues of Oxen and other Animals of the ſame bigneſs. When thoſe ſmall Conical Bodies are pluck'd off, they leave conſiderable Holes in the Reticular Body, and their covers remain in the outer Surface of the Tongue.

Under the Reticular Body, there is a Coat woven of Tendinous Fibres, and Filaments of Nerves of the fifth and ninth pair, upon which appears a prodigious quantity of ſmall *Nervous Papillæ.* Each of theſe *Papillæ* is covered with one of thoſe Conical Bodies of which we have ſpoken. They pierce the Reticular Body, and terminate upon the Surface of the Tongue.

Upon the Tongues of men there are none of thoſe Conical Bodies which are chiefly ſeen on the Tongues of four-footed Creatures. But the *Papillæ* paſs as far as the outer Coat of the Tongue, which they raiſe in ſmall Knobs, and thereby render its Surface very unequal.

There are reckoned three kinds of *Papillæ* both on the Tongues of men, and on thoſe of Oxen, *&c.* The firſt are like the Horns of Snails, having on the top a ſmall round head. They are not numerous; ſome being placed on the ſides of the End of the Tongue, none of them above, but many of them are found on the ſide of its Root. The ſecond are divided into ſmall Fibres, which loſe themſelves in the riſings of the outer Coat of the Tongue, and they are plac'd on its upper part. The Third are Conical, and we find them placed confuſedly amongſt the reſt. They riſe all from the Papillar Bodies, they pierce the Reticular Body, and go to the outer Membrane of the Tongue, which they raiſe in Knobs in men, and there they rencounter the roots of the Conical Bodies in Oxen and other Animals which have them.

In fine, the Tongue has five orders of Fibres by which it makes all its motions, beſides thoſe which are performed by the Muſcles of the *Os Hyoides*. The firſt is of thoſe which are extended in a ſtraight line from its Root to the End, paſſing through the middle of its Body: By their Contraction they ſerve to draw its End towards the Root. The ſecond is of thoſe which paſſing from its Root as far as the End, furniſh its two ſides. By their Contraction, they move the Tongue to the right and left. The third is of thoſe which paſſing from one ſide to the other, are interlaced with the firſt and cut them at right Angles. When they are ſhortned they make the Tongue round. This appears much more towards the End of the Tongue than elſwhere. The fourth is of thoſe which coming from its Root embrace a part of the Tongue; they are interlaced with the Fibres of the firſt and third Order, cutting them obliquely. The effect which the ſhortning of them produceth, is that they draw the Tongue backward, without any conſiderable Contraction. And the fifth is a few Fibres which derive their Origin from the Chin, and are inſerted into the under part of the Tongue, paſſing a conſiderable way into its Body. When they are ſhortned, they draw the Tongue without the Mouth.

Towards the Root of the Tongue, we find many ſmall Glandules, ſituated amongſt its Fibres. They have Excretory Veſſels, which ſend forth Spittle into the Mouth, whoſe Apertions appear in many places of its Surface. Beſides theſe, there are likewiſe ſome others obſerved ſituated on the ſides of the Tongue, they call them *Sublinguales.* They have many Excretory Veſſels, whoſe Orifices do appear on the Gums towards the Hammers. There runs from them, as from the reſt, a clear Tranſparent, and ſomewhat viſcous Liquor.

The Fibres of the Tongue ſhew us that its uſe is to order the Meat in the Mouth, and to make it paſs by its different motions under the Grinders, there to be divided and broken. And by all theſe motions it ſtrikes the Palate, agitates the Maxillar Glandules, its proper Glandules being preſt from time to time, it obliges all its Glandules to ſend forth a conſiderable quantity of Spittle into the Mouth. Thus is it a chief Inſtrument of Chewing.

And in fine, when it is drawn back and raiſed at the ſame time by the Muſcles of the *Os Hyoides*, it preſſes the Meat into a Pipe, called the *Oeſophagus*, which comes to the Cavity of the Mouth, and by this means ſerves for ſwallowing.

DISCOURSE IX.

Of the Oeſophagus.

WHen we trace the Victuals, we find they go from the Mouth into a hollow Pipe which is extended along the Neck and Breaſt, pierces the *Diaphragma* and is inſerted into the Stomach. 'Tis call'd the *Oeſophagus.*

It is very true that the Victuals paſs over a Cartilage, which covers the Orifice of a Pipe that enters into the Breaſt. This Cartilage ordinarily lies high, and the Victuals preſs it down, when they are thruſt by the Tongue into the *Oeſophagus.* 'Tis call'd the *Epiglottis.* But becauſe the Victuals paſs over it, without ſtopping there, and it has no uſe as to them, we ſhall not ſtop at it here, but ſhall reſerve it to another place.

Next after the *Epiglottis* appears the Orifice of the *Oeſophagus* which is call'd the *Pharynx.* It is ordinarily ſhut, and does not open but to give paſſage to what is thruſt forward that way by the Tongue, or to let out what is voided by the Stomach into the Mouth.

It opens and ſhuts as there is occaſion, by the help of ſeven Muſcles. The firſt is called *Oeſophagæus.* It is ſtrongly faſtned to the two ſides of the *Scutiform* Cartilage, and covers the *Oeſophagus* in its winding. Its uſe is to ſhut the entry of the *Oeſophagus*.

The others are double. The firſt are called *Sphæno-pharyngæi*. They take their beginning from within the ſharp *Apophyſes* of the *Os Sphænoides*; and are obliquely inſerted into the ſides of the *Pharynx*, which they open by drawing it upwards.

The ſecond are the *Stylo-pharyngæi*. They ariſe from the extremity of the *Apophyſes Styloides* of the Bones of the Temples, and are inſerted into the ſides of the *Pharynx*, which they dilate by drawing its ſides to the right and left Hand.

The third are the *Cephalo-pharyngæi*. They derive their Original from the Articulation of the Head with the firſt *Vertebra*, and ſpread their Fibres into the ſubſtance of the *Pharynx*, which they ſhut by contraction of their Fibres.

Moreover, the *Oeſophagus* extends its ſelf in a ſtraight line from the *Pharynx* to the Stomach. It is compoſed of three Coats, which may be called, the inner, the middle, and the outer Coat. The inner is made up of nothing but Tendinous Fibres diverſly interlaced. The middle is made up of Carneous Fibres, of which they reckon two Orders, both in Men and in other Animals. In Men the Fibres of the firſt Order reach all along from the *Pha-*

rynx to the Stomach, and thence are named *Fibri Longitudinales*; and thoſe of the ſecond Order are like ſo many little Circles which encircle the *Oeſophagus*, above which the *Longitudinales* are placed. They are called *Circulares.* In Animals, which eat with the Head downward, they have another Poſition. The two Orders of Fibres go ſpirally round about the *Oeſophagus.* And for as much as the one go from the right to the left, whilſt the others paſs from the left to the right, they do in many places paſs one over another. There is ſomewhat ſingular in this paſſing, to wit, That the Fibres which paſs in one place over the others, go under them at the next meeting, at the ſecond they go over; and at laſt paſs under them again. The outer Coat is compoſed of Tendinous Fibres, more fine and ſlender than thoſe of the inner. The inner and outer Coat ſerve for Tendons to the middle. So that we may conſider the *Oeſophagus* as a Muſcle, whoſe inner Coat is the Head, the middle the Belly, and the outer Coat the Tail. So that in Men the *Oeſophagus* is ſhortned by the ſwelling of the *Fibri Longitudinales*; and ſtraitned by the ſhortning of the *Circulares.* This Contraction and Compreſſion of the *Oeſophagus* is called its *Periſtaltick Motion.*

In Beaſts, the ſhortning and ſtraitning of the *Oeſophagus* is much greater than in Men, becauſe the Muſculous Fibres deſcend ſpirally and croſs one another. For when they ſwell, and by conſequence are ſhortned, thereby ſhortning the *Oeſophagus* alſo, they make its Cavity leſs, becauſe by their Action they wreath it.

The uſe of the Periſtaltick Motion is to help forward what has once paſs'd the *Pharynx*, that it may not ſtop in the Cavity of the *Oeſophagus*. So that we may boldly ſay, the *Oeſophagus* was fram'd in this manner, on purpoſe to thruſt the Meat forward by its Periſtaltick motion into the Stomach.

In Beaſts the Periſtaltick motion of the *Oeſophagus* ſtraitens its Cavity much more than in Men, becauſe they Eat ordinarily with their Head downward. There is therefore occaſion for more force to make the Meat paſs through the *Oeſophagus* into the Stomach.

Laſtly, This Periſtaltick motion is called *Vermicularis*, becauſe the *Oeſophagus* moves as Worms do, by ſtraitning and ſhortning its ſelf in one place, and ſwelling in another, which is continued from one end to the other by Undulation. The cauſe of this may be, becauſe the Filaments of the Nerves enter obliquely into the Tendinous Fibres of the Coats. For as ſoon as the Animal Spirits were entered into one Fibre, they would be ſhut up by blowing up the end of the Nervous Filament from whence they come. And ſo ſhutting the door upon others, they would hinder them more from flowing in, till the Fibres were reſtored to their former Eſtate by the force of their ſpring. And in as much as the *Fibri Longitudinales* are all of a piece, and the Circular ones communicate all together by the ſmall Tendinous Fibres, the animal Spirits paſſing farther into the *Fibri Longitudinales*, and running into the neighbouring Circular ones, they would produce there the ſame effect which they had done in the former. So that continuing to run thus from one end of the *Oeſophagus* to the other, they would produce a Vermicular or Undulating motion, by which one place becomes more ſtraitned and ſhortned, then is reſtored into its former eſtate, whileſt this ſtraitning and ſhortning deſcends farther, by degrees to the end.

DISCOURSE X.

Of the Stomach, *and of* Chylification.

THE *Oeſophagus* is inſerted into a kind of bag made almoſt like a Bag-pipe; and this is call'd the *Stomach*. It is ſhort and open at both ends. The place where the *Oeſophagus* joyns it, is on the left ſide, call'd the upper Orifice of the Stomach; and the other place where it is open, which is on the right, is called the *Pilorus*.

The inner Coat of the *Oeſophagus* lies within cloſe about the upper orifice for the ſpace of three inches.

We find that the Stomach is made up of three Coats; the outer and inner are woven of Tendinous Fibres, and the middle is made of Carneous Fibres. All between the inner Tunicle and the middle is fill'd with ſmall Veſicular Glandules. Their Excretory Veſſels pierce the inner Tunicle, and form in its Cavity a ſmall Down, whence it is call'd the *Velvet Tunicle*.

When we examine the Compoſition of the middle Coat, we find ordinarily three orders of Fibres in Beaſts, and two in Men. The firſt is nothing but the continuation of the *Longitudinal Fibres* of the *Oeſaphagus*, which extend themſelves from the upper Orifice of the Stomach as far as the *Pilorus*. And the other is nothing but the Continuation of the *Circular Fibres* of the *Oeſophagus*, which are cut by the *Longitudinals* at right Angles. Thus they appear in Men, in Dogs, Cats, *&c.* Beſides theſe two orders of *Longitudinal* and *Circular Fibres*, there are two Bundles of Fibres extremely cloſe, which extend themſelves to the right and left above the Stomach, from its upper Orifice as far as the *Pilorus*. They are nothing but the *Spiral Fibres* of the *Oeſophagus* which are ſeparated into two Bundles at the upper Orifice, and parting the one from the other, they paſs along above the Stomach, and are reunited at the *Pilorus*.

All theſe different orders of Fibres are made to produce a Periſtaltick motion in the Stomach. It is by means of this motion that the Victuals which enter the Stomach by its upper Orifice, are ſent out by the *Pilorus*.

Moreover the Stomach receives Arteries from the *Cæliack*, ſends Veins to the *Splenick* and to the *Vena Porta*, the *Parvagum* furniſhes it with two conſiderable branches of Nerves, and many Nervous Filaments come from the *Meſenterical Plexus*: and in fine, it gives riſe to ſome *Lymphatick* Veſſels which go into the Reſervatory of the Chyle.

There needed be no more ſaid of the Stomach, were it not that we obſerve that the Victuals receive conſiderable change during their ſtay there. In ſhort it is obſerved that they become Liquid and of a whitiſh colour. This Liquor is called the *Chyle*, and the action that produced it is call'd *Chylification*.

To begin to examine the nature of *Chylification*, I obſere it produceth fluidity in the Victuals which were ſolid. We have learned from Phyſick that Fluidity conſiſts in the diviſion and various motion of the Particles of fluid

Bodies. So that by *Chylification* the parts of the *Victuals* muſt be ſeparated from one another and diverſly moved.

This ſeparation of the parts of Food cannot be done but by bruiſing or Fermentation. We know nothing in the Stomach that can ſo perfectly break and grind the Victuals as to change them into Chyle. We muſt conclude then, that this Separation of the parts of the Aliments is made by Fermentation.

We have obſerved in our Diſcourſe of the Elements of the living Body, that Fermentation is only made by the mixture of two Bodies of a different nature, and that it is done for the moſt part by the mixture of *Acids* and *Alcali's*. Nevertheleſs, ſince *Alcali's* are needful to diſſolve *Sulphurs*, *Phlegms* to diſſolve *Salts*, and *Acids* to diſſolve *Alcali's*, we cannot affirm that the Ferment which by its mixture makes the diſſolution of Food in the Stomach, is only an *Acid*, an *Alcali*, or a *Phlegm*; ſeeing by *Chylification*, both *Salts*, *Sulphurs* and *Alcali's* are diſſolved.

But the Ferment muſt be compoſed of Principles capable of making a Fermentation, ſuch as diſſolve *Sulphurs*, *Alcali's* and *Salts*. And ſince we have aſſerted that *Alcali's* diſſolve *Sulphurs*, *Acids Alcali's*, and *Phlegms Salts*, we muſt from thence neceſſarily conclude that the Ferment of *Chylification*, is a compoſure of *Acid*, *Alcali* and *Phlegm*.

If the Ferment of the Stomach be ſuch, as ſoon as the Victuals ſhall begin to mingle with it, its *Acids* will act upon their *Alcali's*, and by the Fermentation which they ſhall excite with them, will begin to diſſolve the whole Maſs of Victuals. The *Alcali's* of the Ferment coming afterwards to paſs amongſt the Sulphureous parts of the Food will keep them ſeparated from one another.

And in fine, the *Phlegms*, after having diſſolved the *Salts*, will find place amongſt all the parts of the Victuals, whoſe union will be broken by the Action of the *Acids* and *Alcali's*.

Some difficulty may be raiſed upon what we have ſaid, that the Ferment of the Stomach was compoſed of *Acid* and *Alcali*; becauſe theſe two Principles cannot ſubſiſt together without a Fermentation, which would change them immediately into *Salt*. But if we conſider, that certain *Acids* may have their Angles very pointed, and the ſides of theſe Angles very ſlender, and that the Pores of an *Alcali* may be large enough to let the Æthereal matter paſs through, though an Angle of theſe *Acids* be thruſt in there; we ſhall eaſily comprehend after what manner an *Acid* may be mingled with an *Alcali* without exciting Fermentation, and without uniting cloſely with it. For in this caſe there will be Intervals large enough between the Concavity of the Pores of the *Alcali's*, *cali's*, and the ſides of the points of the *Acids* which are placed there, to give paſſage to the matter which flows through their Pores. And ſince it is the obſtacle which this Æthereal matter meets with in its paſſage, which makes it ſeparate the parts of Bodies, it is clear that it needs not here produce any Fermentation.

When therefore the Victuals deſcend into the Stomach by their weight, they preſs the ſmall Glandules, which are placed between its inner and middle Coats. And being nothing but little Veſicles, as ſoon as they are preſt they empty themſelves, and Diſtill into the Cavity of the Stomach, a ſufficient dew of Ferment, which mingles with what is found there, Ferments it, diſſolves it, and makes it Liquid.

That which is Liquified gets above, and obeying the Periſtaltique motion of the Stomach goes out by the *Pilorus*. So long as this Fermentation laſts there goes away always ſomewhat of this ſort, and when it is finiſhed, the Animal muſt eat or he is expoſed to hunger, which proceeds hence becauſe the Ferment being altogether pure in the Stomach it frets the inward Tunicle.

The Ferment of the Victuals never entirely diſſolve the parts, there are always ſome of them which eſcape it. This is the Cauſe that the Chyle is not to be met with at the going out of the Stomach, and that it is mingled with many groſs and uſeleſs parts. It is for this reaſon that nature has made the Chyle to paſs through a long Pipe of Inteſtines, in which it is mingled in divers places with different Liquors, which ſerve to ſeparate what is good from what might be hurtful to the Preſervation of the living Body.

DISCOURSE XI.

Of the Inteſtines.

THE Chyle in going out of the Stomach paſſes into a Duct or Drain join'd to the *Pilorus*, called the *Guts*, or *Inteſtines*. This *Ductus* makes many Circumvolutions; And at laſt, after a great many windings, terminates in the Fundament.

Anatomiſts divide them into ſix parts, to which they give different Names. The firſt, which they call the *Duodenum*, begins at the *Pilorus*, and ends at a place where a yellowiſh and oleous Liquor is diſcharged into the Cavity of the *Inteſtines*. It is ordinarily fill'd with the Chyle as it comes from the Stomach.

The ſecond, which is uſually found almoſt empty, is called *Inteſtinum Jejunum*. It begins at the end of the *Duodenum*, and ends where the Excrements begin. They ſay, 'tis ten or twelve Palms in length.

The third is called *Ilion.* It begins at the the end of the *Jejunum*, and ends at the ſmall end of a Gut, which is faſtned to the Cavity of the reſt, like the bottom of a Sack. Thus far the *Inteſtines* are very delicate and their Cavity but ſmall; wherefore they are called the *Small Guts.* The fourth is called the *Cæcum*, which is the ſmall end of a Gut faſtned to the reſt, of which we have made mention. The fifth is called the *Colon.* It begins at the *Cæcum*, and makes a great Circuit about the other Guts: We find at its entry a Membranous folding, which is ſo framed, that it permits the Excrements to paſs eaſily from the *Ilion* to the *Colon*, but does not ſuffer them to paſs without difficulty from the *Colon* to the *Ilion.* The Cavity of the *Colon* is all divided into little Cells, and it ends at the place where the reſt of the Guts go directly to the Fundament. This makes the ſixth *Inteſtine*, which is called *Rectum.* The *Cæcum*, the *Colon*, and the *Rectum*, are called the *Great Guts*, becauſe their Coats are ſtronger and groſſer than thoſe of the *Small Guts.*

All the *Inteſtines* are made up of three Tunicles, as the *Oeſophagus* of the Stomach. The inner is a Texture of *Tendinous Fibres* diverſly interlac'd; the middle has two Orders of *Carneous Fibres*, of which the one is *Circular*, and the other *Longitudinal:* And the outer is a Texture of *Tendinous Fibres.* Theſe Tunicles ſerve to make the *Periſtaltick motion* of the Guts, after the ſame manner as in the *Oeſophagus* and Stomach. This Vermicular motion ſerves to force what is lodg'd in the Guts down to the Fundament, in order to Evacuation.

Beſides the three Tunicles of which we have ſpoken, we obſerve in the ſubſtance of the *Small Guts*, a heap of little Glandules, which ſend their Excretory Veſſels into the Cavity of the *Inteſtines*, and Diſtill there a clear and tranſparent Liquor. We ſhall ſhew its uſe when we ſpeak of the changes which the Chyle receives in paſſing into the *Inteſtines.*

The Chyle is not very Liquid when it comes out of the Stomach: It reſembles ſomewhat Paſte made of Meal and Water; being of a grayiſh colour, like to it, and has much of Viſcoſity: But it continues not long ſo. For it has no ſooner paſt the *Duodenum*, but a yellow and extremely bitter Liquor, which is called the *Bile*, mingles with it.

DISCOURSE XII.

Of the Bile *and* Liver.

WHen we enquire by Chymiſtry what are the Elements of the *Bile*, we find that it is compoſed of much fixt *Alcali*, a little *Volatile*, a little of *Sulphur*, yet leſs of *Earth*, and much of *Phlegm*.

From whence we may conclude, that the *Bile*, mingling its ſelf with the Chyle, receives in its *Alcali's* both fixt and *Volatile*, a part of the *Acids*, which hold its *Sulphurs* united together, and thereby keep up the Viſcoſity which it has in the *Duodenum*. So that the *Sulphurs* of the Chyle are after this more at liberty, and more ſeparated one from another. Wherefore they receive amongſt their parts, the *Phlegm* of the *Bile*, which dilate the whole Maſs and give it a greater fluidity.

The *Bile* is diſcharged into the Cavity of the Guts, at the end of the *Duodenum* by a ſmall Hole, round which is obſerved a ſmall Spongious edge. If you put a Probe into this ſmall Hole, it paſſes into a Membranous Duct, which reaches to the *Liver*. This Duct is always full of *Bile*, and is therefore called *Canalis Cholidochus*.

The Inſertion of this Veſſel into the Inteſtines is ſomething remarkable. At firſt it creeps above the hinder part of the *Duodenum*, and then pierces its outer Coat: Afterwards it pierces its middle Tunicle after having deſcended for ſome ſpace between that and the outer Coat: And at laſt, after having gone ſome way between the middle Tunicle and the inner, it pierces the inner at the place where we have obſerved the little Hole through which the *Bile* flows into the Inteſtines.

The Obliquity of this Inſertion ſerves to make the *Bile* run into the Inteſtines. And the ſpongious edge which environs the little Hole hinders the *Bile* from returning from the Inteſtines into the *Ductus Cholidochus*. For the ſpongious edge is a ſmall *Sphincter* which keeps the little Hole ſhut, when the *Bile* does not keep it open by flowing into the *Guts*. And the *Periſtaltick motion* of the Inteſtines paſſing towards the little Hole, ſerves ſucceſſively that part of the *Ductus Cholidochus* which creeps amongſt the Membranes of the *Duodenum*; and thereby obliges all the *Bile* that is in this part of the *Ductus Cholidochus* to run into the Cavity of the *Guts*.

After having conſidered all this exactly, I follow the *Ductus Cholidochus* towards the *Liver*, and find that it is forked there, and that one of its branches goes to a Bladder ſituated near the concave part of the *Liver*, whilſt the other goes to the *Liver*. They call the branch which goes to the Bladder *Ductus Cyſticus*, and that which goes to the *Liver*, *Ductus Hepaticus*, and the Trunck which ariſes from the joyning of both theſe which is inſerted into the end of the *Duodenum*, *Ductus Communis*.

The Hepatick Duct enters into the *Liver*, accompanied with two Arteries, two Nerves and the *Vena Porta*. All theſe Veſſels are ſhut up in a Membranous ſheath, which they call *Gliſſon's Capſula*. As ſoon as they enter the *Liver*, they are divided into many branches, and theſe branches into others, and thus they continue to divide till they be ſpread through all the ſubſtance of the *Liver*.

It is here to be obſerv'd that all theſe Veſſels continue ſtill to be ſhut up in *Gliſſon's Capſula*. It accompanies them through all, and follows all their ramifications.So that where-ever there is a branch of an Artery, there is alſo a branch of the *Vena Porta*, and one of the *Ductus Cholidochus*, and the whole is ſhut up in a branch of the *Capſula*. As for the Nerves they follow alſo the ramification of the other Veſſels for ſome ſpace,and at laſt form a ſmall net, which enfolds the *Arteries*.

From this by the way we may conclude that the *Vena Porta* does not beat in the *Liver*, as ſome Authors have imagined ; but that the beating of the *Capſula* proceeds from the beating of the *Arteries* which are ſhut up in it.

All theſe Veſſels enter into ſmall *Lobes*, the Meeting whereof makes up the *Liver*. Each *Lobe* is ſhut up in a very delicate *Membrane* which divides it from all the reſt. Nevertheleſs it ceaſes not to adhere to them by ſmall *Tendinous Fibres*. The *Membrane* which enfolds each *Lobe* changes into a part of the *Capſula*, enfolding all the Veſſels which enter into the *Lobe*. So that *Gliſſon*'s *Capſula* is nothing but the continuation and re-union of all the *Membranes* which encompaſs the ſmall *Lobes* of the *Liver*.

All theſe *Lobes* are made up of little *Vaſcular Glandules*, which touch one another. Each *Glandule* receives a branch of an *Artery* and of the *Vena Porta*, and there goes from it a branch of the *Ductus Cholidochus*, which is only a continuation of the Veſſel of the *Glandule*. They are faſtned to theſe ſmall Veſſels as Raiſins to the Stalk of the Grape. There goes alſo from each *Glandule* a branch of the *Hepatick Vein*; which being united make up a conſiderable Trunk, which goes from the *Liver* at its convex part, and enters into the aſcending *Vena Cava*.

The *Vena Porta* and the *Arteries* bring the Blood to the *Glandules* of the ſmall *Lobes*, the branches of the *Hepatick Vein* carry it away again into the *Vena Cava*, and the *Ductus Cholidochus* tranſports the *Bile* into the end of the *Duodenum*, which the *Glandules* of the ſmall *Lobes* have ſeparated from the Blood.

This is what we have diſcovered in following the Ramifications of the *Ductus Hepaticus*. Let us now trace the *Ductus Cyſticus*: And firſt 'tis obſervable that it is ſtraitned by a ſmall Fibrous Ring at its Inſertion into the Veſicle of the *Bile*. So that this Fibrous Ring performs the office of a ſmall *Sphincter*, which ſhuts the entry of the *Veſicle*, and hinders the *Bile* which uſually fills it, from getting out, unleſs it be forced. Afterwards I conſider the *Veſicula Fellis*. It has the figure of a ſmall Pear, and receives *Arteries* from the *Arteria Cæliaca*, which are called the *Cyſtick Arteries*. It is made up of two Tunicles, between which there are a prodigious number of ſmall *Veſicular Glandules*; which receive branches from the *Cyſtick Arteries*. The Excretory Veſſels of theſe little *Glandules* pierce its inner Coat, and make within its Cavity a ſmall Down, from whence their flows a very clear and tranſparent *Bile* in form of a Dew. This *Bile* differs from that which flows from the *Ductus Hepaticus*, in this, the former is of a deeper colour and abounds more in a fixt *Alcali*, whereas this is more fluid, and has more of a *Volatile Alcali* than the other.

All the *Bile* found in the *Veſicula Fellis*, comes not only from the *Veſicular Glandules* ſituated between its Tunicles; but a great part of it from the *Lobes* of the *Liver* which are about the *Veſicle.* They diſcharge themſelves into its Cavity by two or three *Ductus Cholidochi*, which are inſerted into that part of it that adheres to the *Liver*. Amongſt the reſt there is one pretty large which pierces the Tunicles of the *Veſicula Fellis* near the Fibrous Ring. The mouth of this Veſſel is encompaſſed with a ſmall Spongious border, which ſerves it for a *Sphincter*.

There goes a great number of *Lymphatick Veſſels*, both from the concave part of the *Liver*, and from the *Veſicle*, which enter into the Reſervatory that is placed above the *Vertebræ* of the Loins.

In fine, the *Liver* has three Ligaments which keep it in its ſituation. The firſt keeps it ſtrongly faſtned to the *Diaphragma*, and pierces into the ſubſtance of the *Liver*, even to *Gliſſon's Capſula.* The ſecond is of a good length, faſtned to the *Liver* near the Bladder of the Gall, and goes to the Navel. The third is ſlack, but ſtrong and large. It derives its Origin from the *Membrane* which encompaſſes the whole *Liver*, and which is a production of the *Peritonæum*, and goes from thence to the *Xiphoid Cartilage.*

Its upper part is Convex, and its under Concave, is divided into three or four great *Lobes*, and with its under part it embraces a part of the Stomach. So that when the Stomach is full of Meat, the Bladder of the Gall being then preſt, the *Bile* goes out by the Cyſtick *Channel*, and runs in abundance into the *Duodenum*, to diſſolve the Chyle as it comes from the Stomach.

From all this therefore, we may conclude that the uſe of the *Liver* is to ſeparate the *Bile* from the Blood, to perfect the Chyle in the Inteſtines, by diſſolving its *Sulphurs* by its *Alcali's*, and by diluting it with its *Phlegm*.

DISCOURSE XIII.

Of the Changes which the Chyle *receives in the* Inteſtines.

BEſides the *Bile* which is diſcharged into the *Duodenum*; there is alſo another Liquor, clear and tranſparent as Water, which advances thither, and which they call the *Pancreatick Juyce*. This *Pancreatick Juyce* is ſomewhat of the ſame nature with the *Lympha*, that is, it is compoſed of *Sulphurs*, *Phlegms* and *Volatile Alcali's*.

As ſoon as it falls into the *Inteſtines*, it mingles with the *Chyle*. If it meets with any *Acids* in the *Chyle*, which keep its *Sulphurs* united, its *Volatile Alcali* charges its ſelf with them, which frees the *Sulphurs* from the other Principles. The *Sulphurs* which are in the *Pancreatick Juyce*, thruſt themſelves amongſt the parts of the *Chyle*. They moderate the Fermentation of the *Alcali's* with the *Acids*, and hinder it from being done with too much Violence, which would occaſion much diſorder. And the *Phlegm* makes way to the *Alcali's* and *Sulphurs*, and they mingle more readily with all the parts of the *Chyle*.

From all this it clearly follows that the *Pancreatick Juyce* perfects the *Chyle* and renders it more Liquid. In men the *Pancreatick Juyce* and the *Bile* enter the *Inteſtine* at the ſame Hole. And in moſt part of other Animals the *Ductus Pancreaticus* is inſerted into the *Jejunum* two Inches below the Inſertion of the *Ductus Cholidochus*. We obſerve in this Inſertion of the *Ductus Pancreaticus*, almoſt the ſame circumſtances which have been obſerved in the Inſertion of the *Ductus Cholidochus*. About the little Hole from whence the *Pancreatick Juyce* flows into the Cavity of the *Inteſtines*, there is a little Fibrous edge, which ſerves it for a *Sphincter*, and hinders any thing from paſſing from the *Inteſtines* into the *Ductus Pancreaticus*.

This Duct is made of many others, which ſpread through a Glandulous Body, called the *Pancreas.* The *Glandules* which compoſe it, are Vaſcular of a reaſonable bigneſs. There goes from each a ſmall Duct which is inſerted into the *Ductus Pancreaticus*, and Diſtills into its Cavity the Liquor which the *Glandule* has ſeparated from the Blood.

The whole *Pancreas* is covered with one Tunicle. It receives Arteries from the *Arteria Cæliaca*, it ſends Veins to the *Splenica*, and ſome Ramifications of the *Intercoſtalis* come thither, and ſpread through all its Body.

It is ſo neceſſary for the conſervation of a living Creature, that the *Chyle* be freed of its *Acids*, that the Author of nature has plac'd many heaps of *Veſicular Glandules* between the Tunicles of the ſmall *Inteſtines.* They diſtill into theſe places a Liquor like unto the *Pancreatick Juyce*, which by its mixture with the *Chyle*, finiſheth what the *Bile* and the *Pancreatick Juyce* had ſo well begun.

Theſe ſmall heaps of *Glandules* are of different bigneſſes. Some of them contain more than two hundred *Glandules*, and others not thirty. Sometimes there are four of them, ſometimes five, and ſometimes ſix. Sometimes there are two of them in the *Jejunum*, ſometimes three, and ſometimes but one: we find always two or three ſuch heaps in the *Ilion.*

All the parts of the *Chyle* are not fit to paſs into the ſmall Veſſels which are called the *Lacteal Veins.* Some of them being too groſs, *viz.* the groſs Excrements. The *Chyle* abounds in parts fit to paſs into the *Lacteal Veins*, after that it has been prepared by the *Bile*, and the *Pancreatick Juyce*: For this reaſon it is that its maſs diminiſhes ſo much in the *Inteſtinum Jejunum*, becauſe its more ſubtile parts get out and paſs into the *Lacteal Veins.* So it is obſerved, there are more *Lacteal Veins* of the *Jejunum*, than of all the other *Inteſtines.* At the end of the *Jejunum* ſome Excrements are found mingled with many Chylous parts. The *Glandulous juyce* mingles with them and diſſolves the *Sulphurs* from the Chylous parts which are there. What has thus been prepared paſſes likewiſe into the *Lacteal Veins.* Theſe Excrements afterwards paſs into the *Ilion*, where in divers places they receive again of the *Glandulous juyce*, which produces the ſame effect as formerly. In fine, after they are entirely freed of their Chylous parts, they paſs into the greater *Inteſtines.* They are then compoſed of parts which the Ferment of the Stomach could not diſſolve, and of *Salts* which are formed by the union of *Alcali's*, of the *Bile*, of the *Pancreatick juyce*, and of the *Glandulous juyce* with the *Acids* which were engaged amongſt the parts of the *Chyle.*

DISCOURSE XIV.

Of the Meſentery, *the* Lacteal Veins, *Pecquet*'s Reſervatory, *and the* Thoracick Duct.

THE Inteſtines adhere to the Circumference of a Membranous Ruff, which they call the *Meſentery.* The middle of it is ſo ſtrongly faſtned to the *Vertebræ* of the Loins, that it cannot be ſeparated from them, unleſs you tear a part of it, or cut it. It is compoſed of two Membranes, of which the upper is a continuation of the *Peritonæum*, and the inferiour a Texture of *Tendinous Fibres* which come from the *Vertebræ* of the Loins.

The *Meſenterick Artery* ſpreads many branches amongſt the Membranes of the *Meſentery*, one part of which goes to the Inteſtines, and the other is ſpread amongſt the Fibres of the Membranes which compoſe it. The Veins which come from the Inteſtines are likewiſe ſpread between the Membranes of the *Meſentery*, and many ſmall Veins which come from amongſt their Fibres, go thither. They are called the *Meſaraick Veins.* They go to the *Vena Porta.* Many Nerves which ariſe from the *Vertebræ* of the Loins, and from the *Intercoſtal*, are ſo interwoven one with another upon the *Meſentery*, that they form a *Plexus* which is called the *Meſenterick Plexus*. Many Nervous Fibres go from it, which are ſpread amongſt the Fibres of the Membranes of the *Meſentery*, a part of which paſſes as far as the Guts.

The middle between the Membranes of the *Meſentery* is fill'd with Fat. It appears chiefly about the *Meſaraick Veins*. In the midſt of it we find a large Glandule, and ſometimes two, three or four. In Oxen and ſome other Animals there are many more near the ſmall Guts. The knowledge of the ſtructure of theſe Glandules does admirably ſerve to explain their uſes. They are a heap of angular Veſicles. There is a communication between their Cavities. This is found by blowing into them after you have thruſt out all that fills them. The Air paſſes from one Veſicle to another, and makes them appear ſuch as we have deſcribed them.

In fine, we diſcover between the Membranes of the *Meſentery* certain ſmall Veſſels, which come from the Inteſtines and paſs into the Glandules of which we have ſpoken.

Theſe Veſſels are ordinarily full of *Lympha*, and ſometimes we find them full of a Liquor like Milk, which is the reaſon why they are call'd the *Lacteal Veins*.

This Milk is nothing but pure Chyle, which has paſt from the Cavity of the ſmall Guts into that of the *Lacteal Veins.* There are four Experiments which confirm us in this Opinion. The firſt is, that the Milk which runs into the *Lacteal Veins* comes from the Inteſtines; this truth is evident beyond exception; for when the *Lacteal Veins* are preſt with the Fingers, they empty themſelves of the Milk, and we ſee it come afterwards from the ſide of the Inteſtines to fill the Vein which has been emptied. The ſecond is, that Milk is not to be found in the *Lacteal Veins*, except it be ſome Hours after the Animal has eaten. The third is, that we find the *Jejunum* almoſt always empty, becauſe of the great number of *Lacteal Veins* which go from it.

Further, the *Lacteal Veins* have many Valves plac'd very near one another. They are ſo diſpoſed that they permit the Chyle to run eaſily into the *Lacteal Veins* in going from the Inteſtines to the Glandules of the *Meſentery*, but they hinder its return. They go from the Inteſtines in great number, and they are Inoculated many of them together according as they advance. By this means they make up ſome greater Veſſels which empty the Chyle that they carry, into the Veſicles of the Glandules of the *Meſentery*.

The *Chyle* goes into the *Veſicles* of theſe *Glandules*, there to receive Animal Spirits, which come thither in abundance by many Nerves which proceed from the *Plexus Meſentericus*. Theſe Spirits render the *Chyle* more ſubtile and fluid by their *Volatile Alcali*, and if there be any *acidity* in it, they correct it, by receiving it into their *Alcali's* and changing it into *Salt*.

After the *Chyle* has paſt through the *Veſicles* of the *Meſaraick Glandules*, it diſcharges it ſelf into two or three Canals which riſe under them. They end afterwards in a Membranous bag ſituated above the *Vertebræ* of the Loins, they call it the *Reſervatory* of the *Chyle*. The *Reſervatory* is the ſame with the *Ciſtern* of the *Lympha*, of which we have ſpoke before. In this place the *Chyle* is mingled with much *Lympha*, with which the *Reſervatory* is always full. It dilates it, and renders it more Liquid, that it may run the more eaſily.

In fine, there goes from the *Reſervatory* of the *Chyle*, a Duct or Drain, which is called the *Thoracick Duct*, becauſe it goes along the *Vertebræ* of the *Thorax*. Sometimes this *Ductus* is forked, and its branches unite again, ſometimes it is altogether ſimple.

The *Thoracick Duct* or *Drain* is inſerted into the *Subclavian Vein*; above its Inſertion there is a *Valve*, which like a ſmall Vault, covers it. So that the Blood which runs through the *Subclavian Vein*, runs by without hindring the entry of the *Chyle*.

When we blow in the *Thoracick Duct*, we perceive many *Valves* in its Cavity. They are plac'd at very ſmall diſtances from one another, and are ſo diſpoſed that they permit the *Chyle* eaſily to run towards the *Subclavian Vein*, but they hinder it from deſcending into *Pecquet*'s *Reſervatory*.

From whence we may conclude that the *Chyle* runs from its *Reſervatory* by the *Thoracick Duct* into the left *Subclavian Vein*. There it mingles with the Blood, whoſe courſe it follows and goes into the *Vena Cava*, which carries it into the right *Auricle* of the Heart. The *Auricle* diſcharges it into the right *Ventricle*. And as the *Chyle* makes then a part of the Blood, it follows its courſe, and circulates with it through all the Body.

DISCOURSE XV.

Of the Heart.

WHen the *Chyle* is once entered into the *Subclavian Vein*, it mingles its ſelf with the Blood, and follows its courſe. We muſt therefore follow the Blood, if we would know what becomes of the *Chyle*.

The Circulation of the Blood ſhews us that it runs from the *Subclavian Vein* into the *Vena Cava*, and from the *Vena Cava* it paſſes into a bag adhering to the right ſide of the Heart. This little bag they call the *right Auricle of the Heart*. When this *Auricle* is full of Blood it contracts its ſelf, and in contracting ſheds it into a Cavity which we find in the Body of the Heart on its right ſide. This Cavity is called the *right Ventricle of the Heart*. As ſoon as the *Ventricle* is full of Blood, it contracts its ſelf, and thereby empties by contraction.

It is here to be obſerv'd, that at the opening of the right *Auricle* into the right *Ventricle* of the Heart, there are certain ſmall Skins, call'd *Valves*. They are three in number, almoſt of a triangular Figure, whoſe ſides are notched. Their Root joins to the opening of the *Auricle*, and they terminate within the *Ventricle*. Their Extremity is upheld only by ſmall Tendinous Fibres, ſtrong and of a good Length, which without being ſtretch'd are ſtrongly faſtned to ſmall carneous Supporters, plac'd upon the concave ſurface of the *Ventricle*. This diſpoſition plainly ſhews that theſe *Valves* are ſo many ſmall doors, which the Blood opens of its ſelf, when it runs from the *Auricle* into the *Ventricle*, and which it ſhuts after it is entered there. Indeed as ſoon as the *Ventricle* is full of Blood it contracts its ſelf, and the Blood is thereby preſt equally on all ſides. By this means it gets under theſe *Valves*, lifts up the end thereof towards the opening of the *Auricle*, which is thereby ſo cloſe ſhut, that no drop of Blood can paſs that way. Thus the Blood ſhuts up it ſelf, and cannot get out the way by which it entered. Nevertheleſs it does not ſtay in the right *Ventricle* of the Heart, it goes out by another door, to which the Riſe of an Artery is ſtrongly faſtned. This Artery is divided into many branches, which diſtribute themſelves into the *Lobes* of the Lungs. As it paſſes from the right *Ventricle*, it has in its Cavity three *Valves* made like *Creſcents*, and ranked each at the ſide of the other. Their Convexity cleaves to the Artery and turns towards the *Ventricle*, and their Concavity is diſengag'd and turned towards the Artery. This ſituation ſhews us that they do not oppoſe the motion of the Blood when it comes from the *Ventricle* to the Artery, but by riſing up they ſtop its courſe if it preſs from the Artery into the *Ventricle*.

After the Blood has paſt from the right *Ventricle* into the Lungs by the *Pulmonary* Artery, it returns from them by a Vein, which is called the *Pulmonary Vein*. This *Pulmonary Vein* diſcharges its ſelf into a little bag, faſtned to the left ſide of the Heart, which is called the *left Auricle*. As ſoon as this *Auricle* is full, it contracts its ſelf, and thereby forces the Blood into a Cavity in the ſubſtance of the Heart, plac'd on its left ſide, which is called the *left Ventricle*. As ſoon as this Cavity is full of Blood it contracts it ſelf, and thereby throws out all the Blood which it contains.

That we may learn where the Blood goes when it paſſes from the left *Ventricle* of the Heart, we are to take notice that at the opening of the left *Auricle* there are *Valves* ſituated, after the ſame manner as at the opening of the right *Ventricle*. Their uſe alſo is the ſame. They permit indeed the Blood to run from the *Auricle* into the *Ventricle*, but they hinder it from coming out of the *Ventricle* into the *Auricle* when the Heart contracts its ſelf. The Blood therefore takes another way. It goes out of the left *Ventricle* by another paſſage, which makes the beginning of the great Artery, call'd *Aorta*. We find in the Cavity of this Artery next to the Heart, three *Valves* made *Creſcent* ways, diſpoſed after the ſame manner as thoſe of the *Pulmonary Artery*. They permit the Blood to go out of the left *Ventricle* and to run into the *Aorta*, but they hinder the Blood from flowing back from the *Aorta* into the left *Ventricle*.

There is yet an important Obſervation to be made upon the motion of the *Auricles* and *Ventricles* of the Heart; which is this, The two *Auricles* contract and dilate themſelves at the ſame time, and the two *Ventricles* in like manner. With this Difference, that when the *Auricles* contract themſelves, the *Ventricles* are dilated, and when the *Ventricles* contract themſelves; the *Auricles* are dilated in courſe. Which makes us conjecture, that the Heart is a *Muſcle*, whoſe *Auricles* may well be reputed the *Antagoniſt Muſcles*.

Before we enquire if this conjecture be a truth, it will not be impertinent to obſerve, that ſince the *Auricles* contract themſelves at the ſame time, they do alſo at the ſame time pour the Blood into the *Ventricles* of the Heart. By the ſame reaſon the *Ventricles* of the Heart do at one time preſs the Blood into the *Pulmonary Artery*, and into the *Aorta*.

When we conſider the Heart narrowly, we perceive that it is compoſed of fleſhy Fibres, which, have all of them communication with a Membrane made of *Tendinous Fibres*. This Membrane is plac'd at the Baſe of the Heart, and keeps the *Auricles* fixt to it. Which makes us judge that the Heart is a *Muſcle*.

In the Heart we obſerve three orders of Fibres, the firſt is, of thoſe which go in a ſtraight line from the *Baſis* of the Heart juſt to its Extremity; lying in a ſmall number over the right *Ventricle*. The ſecond is of thoſe which go from the *Baſe*, and after they have extended themſelves to the middle of the Heart; return again to the *Baſe* from whence they came. The third is of thoſe which go from the *Baſe* and come to the Extremity, deſcribing about the Heart a ſpiral Line. There they re-enter within the Heart, and return ſpirally towards the *Baſe*. Some of them end in the *Ventricles*, where they make a Texture of their Tendinous Fibres, which covers them on all ſides. Some of thoſe alſo which come into the *Ventricles* make thoſe little Eminencies which are called *Pillars*. From the Extremity of theſe Pillars go many Tendinous Strings, which are joined to the Teeth of the *Valves* that are plac'd in the opening of the *Auricles*.

All theſe Orders of Fibres ſerve by the ſhortning of themſelves to contract the *Ventricles* of the Heart. The ſtraight Fibres ſhorten it, the circular ones ſtraiten it, and the ſpiral wring it. The Heart cannot be thus ſhortned, ſtraitned and wreathed, but the *Ventricles* muſt needs be contracted. From whence we muſt conclude, that the Heart is a Muſcle, whoſe action conſiſts in ſtraitning the Cavities which are amongſt its Fibres.

As for the *Auricles*, they are alſo compoſed of Carneous Fibres, of which ſome of them are interwoven with others. They are extended for the moſt part at full length, and thoſe of them which are interwoven ſeem to croſs them to become Circular. The ſhortning of the firſt diminiſhes the length of the *Auricles*, and the ſhortning of the other diminiſheth their breadth. Which ſhews us that the *Auricles* are nothing but Cavernous Muſcles, whoſe action conſiſts in the contraction of their Cavity.

There is a communication between the Fibres of the Heart and thoſe of the *Auricles*, by the interpoſal of the Tendinous Fibres, which are united in their purity at the *Baſe* of the Heart. We may look upon them as a *Tendon* common to the *Heart* and the *Auricles*. The Animal Spirits therefore which the Nerves diſtill into this *Tendon*, do eaſily paſs from the Fibres of the *Heart* into the Fibres of the *Auricles*, and from the Fibres of the *Auricles* into thoſe of the *Heart*.

If we would yet form to our ſelves an *Idea* of the Heart as clear and diſtinct as may be, we may conſider it as a *Muſcle* with three Bellies. Each *Auricle* makes one, and the Body of the Heart makes the third, and the Membrane which is at the *Baſe* of the Heart where the Fibres of the Heart and of the *Auricles* meet, would be the common *Tendon*.

The Heart receives Arteries from the *Aorta*, it ſends Veins to the *Cava*; it receives Nerves from the *Plexus Cardiacus* and the *Par Vagum*.

In fine, the Heart is ſhut up in a Membranous Bag called the *Pericardium.* The *Pericardium* is ſtrong and formed of a Texture of the Tendinous Fibres of the Heart, of ſome *Veins*, ſome *Arteries* and ſome *Nerves*. It contains always a little Seroſity, which the ſmall *Glandules* that are plac'd amongſt the Fat of the *Baſe* of the Heart diſtill into it.

From what has been ſaid, we may conclude, that when the *Auricles* are full of Blood, the *Ventricles* of the Heart are empty. And becauſe the *Auricles*, as ſoon as they are full of Blood, contract themſelves; the Blood which they preſs into the *Ventricles* of the Heart, being aided by the ſpring of their Fibres, dilate them, and forces the Animal Spirits out of them, into the *Auricles* to compleat their contraction. But as ſoon as the *Auricles* are contracted, the Blood which advances on all ſides, joyn'd with the force of the ſpring of their Fibres, reſtores them to their former ſtate. And the Spirits paſſing in that moment from the *Auricles* to the Heart; ſhut it up, and cauſe its contraction. For this Reaſon it is that the *Auricles* empty themſelves when the *Ventricles* of the Heart are filled, and the *Auricles* fill themſelves when the *Ventricles* are emptied.

The Heart by its Contraction throws the Blood from its *Ventricles* into the Arteries.

But becauſe the Arteries become ſtill narrower, the Blood cannot be thrown out impetuouſly without ſwelling them. When they are thus blown up, they reſtore themſelves to their former ſtate by the ſpring of their Fibres, and by this means make a part of the Blood which they have received run into the Veins of the Heart. And ſince the Heart throws out the Blood into the Arteries by ſeveral ſtrokes, the Arteries muſt needs be blown up and fall again as they fill or empty by the blood ſo forced into them. It is this motion of the Arteries which they call the *Pulſe*, concerning which it is to be obſerved that the dilatation of the Arteries accompanies the contraction of the Heart, and the contraction of the Arteries accompanies its dilatation.

Thoſe that will be ſatisfied with what is demonſtrable, will allow the Heart to be the office for preſſing the Blood into the Arteries, and the principal Inſtrument of its Circulation. Hereafter we ſhall make appear the Falſity of that ill-grounded Opinion, of the Heart's being the Organ of Sanguification; in the mean time, leave thoſe of that Opinion to enjoy the Satisfaction of being deceived.

DISCOURSE XVI.

Of the Lungs.

WE have ſaid in the preceeding Chapter, that when the Blood goes from the right *Ventricle* of the Heart it paſſes into the *Pulmonary Artery*. This *Artery* is divided into many great branches which enter into the Body of the Lungs, and theſe branches are again divided into others, and theſe into others, till at laſt the ſmalleſt of them are loſt into the ſubſtance of the Lungs.

The *Pulmonary Artery* is not ſpread alone in the Lungs. It is every where accompanied with the *Pulmonary Vein*, a branch of a Nerve which comes from the *Par Vagum*, a ſmall Artery which goes from the *Aorta*, and which they call the *Bronchial Artery*, with a ſmall Vein which is paſſing into the *Vena Cava*, and which they call the *Bronchial Vein*; and a certain Cartilaginous Duct, which is called the *Bronchiæ*.

The *Bronchiæ* are only the Ramifications of a great Cartilaginous Pipe, which extends its ſelf from the bottom of the Mouth, as far as the Lungs. It lieth above the *Oeſophagus*, and is plac'd in the fore-part of the Neck. They call it the *Arteria Trachæa*.

There is at the top of the *Arteria Trachæa* a horny part, called the *Larynx*. It is made up of five *Cartilages*. That which takes up its fore-part, makes that Eminence which in men they call *Adam*'s *Bit*. Its Figure is almoſt like unto that of the Buckler, which the Latines call *Scutum*. For this reaſon they name it the *Scutiform Cartilage*. The ſecond is called the *Annular*. It is made like the Ring which the Turks make uſe of for drawing the Bow. It is ſtrait before and large behind. It embraces the whole *Larynx*, and is faſtned into the *Scutiform*. The third and fourth are called the *Arytænoides*. They are the productions of the *Annular*, placed on its hinder part, and ſeparated from one another by a ſmall ſlit. They make that part of the *Larynx* which they call the *Glottis*. The fifth is a *Cartilage* faſtned above the upper part of the *Scutiform Cartilage*. They call it the *Epiglottis*. Its Figure is Triangular, and its ſubſtance ſofter than that of the others. Its Root cleaves to the *Scutiform Cartilage*, and the reſt of its Body is diſengag'd from any other part. It is uſually lifted up. This is that *Cartilage* which the Victuals depreſs in paſſing from the Mouth into the *Oeſophagus*. When it is down it ſhuts the entry of the *Trachæal Artery*, and thereby hinders the Food from going into it.

The *Larynx* is reckoned to have thirteen

Muſcles. There are four of them common to it with other parts, and nine properly appertain to it. The firſt pair of the common ones are nam'd *Sternothyroidæi.* They ariſe from the top of the *Sternum*, lie above the *Trachæal Artery*, and are faſtned to the inferiour part of the *Scutiform Cartilage.* When their Fibres are contracted they draw the *Scutiform* downwards. The ſecond pair is made of the *Hyothyroidæi.* They ariſe from the Root of the *Os Hyoides*, and are faſtned to the Bottom of the *Scutiform.* They ſerve by the contraction of their Fibres to raiſe the *Larynx.*

The firſt pair of Muſcles proper to the *Larynx* is made of the anteriour *Cricothyroidæi.* They derive their Origin from the fore-part of the *Annular Cartilage*, and end at the lower part of the ſame *Cartilage.* By their Action they dilate it. The ſecond is made of the Poſteriour *Cricothyroidæi.* They ariſe from the top of the *Annular* at its hinder part, and come to the ſides of the *Scutiform* at its upper part. When they act they ſtraiten the *Scutiform.* The third is made of the *Cricoarytænoidæi.* They derive their Origin from the inner, and ſide-part of the *Annular*, and are inſerted into the under-part and the ſides of the *Arytænoides.* By their Contraction they dilate the *Glottis.* The fourth is made of the *Thyroarytænoidæi.* They come from within, and from the middle of the *Scutiform*, and terminate in the ſides of the *Arytænoides*. By their action they ſhut the *Larynx*. The ninth Muſcle is call'd the *Arytænoidæus*. It ariſeth from the place where the *Annular* is join'd with the *Arytænoides* which it ſtraitens when it acts.

The *Larynx* covers the top of the *Trachæal Artery*, whoſe frame is very ſingular. Firſt we find it covered with a very delicate Membrane, whoſe Fibres are diverſly interwoven: Then under this Membrane there are Cartilaginous Rings: Theſe Rings are entirely Cartilaginous except on their Back-ſide, where they are Membranous, and where they touch the *Oeſophagus*. They are Membranous and not Cartilaginous that they may give way to the *Oeſophagus*, when any great and hard morſel paſſes along its Cavity.

Theſe Cartilaginous Rings are not all of the ſame Bigneſs. That which upholds the *Larynx* is greater and larger than the next to it, and this larger than the next, and ſo forward. So that the nearer they approach the Lungs they diminiſh in breadth. They are all united together by carneous Ligaments, and it is obſervable that they are all equally diſtant one from another.

When they enter into the Body of the Lungs they are called *Bronchiæ*. There they ceaſe to be Membranous on their back-part, and become entirely Cartilaginous. And whereas in the *Trachæal Artery* its Rings are equally diſtant from one another, in the *Bronchiæ* they are joined in ſuch a manner as that a part of the Inferiour Ring enters into the Cavity of its Superiour.

The Cartilaginous Rings of the *Trachæal Artery*, and of the *Bronchiæ*, cover a *Tunicle* compoſed of three principal Parts. As ſoon as you raiſe up one of the Cartilaginous Rings you find a Muſculous *Tunicle.* Its Fibres are diſpoſed as the Fibres of the middle *Tunicle* of the *Inteſtines.* The *Longitudinales* appear firſt and then the *Circulares*, which are plac'd exactly under the *Longitudinales.* This *Carneous Tunicle* covers another *Tunicle* which is only a Collection of ſmall *Glandules*, juſt as the *Carneous Tunicle* of the Stomach immediately covers the *Glandulous.* Laſtly, under this *Glandulous Tunicle* is another, which is only a Texture of *Tendinous Fibres* which come from the *Carneous Tunicle.* There are ſome *Filaments* of *Nerves*, and ſome ſmall *Arteries* and *Veins.*

In the Lungs the *Trachæal Artery* is divided into many branches. Theſe branches are again ſub-divided into many more, and theſe again into many others, and ſo onward till the laſt end in an infinite number of ſmall *Veſicles.* Theſe *Veſicles* make the Subſtance of the Lungs.

The *Veſicles* which are gathered about one end of the *Bronchiæ* are all encompaſſed with one *Membrane.* This *Membrane* is nothing but the continuation of the outer *Tunicle* which covers the *Trachaal Artery* and the *Bronchiæ.* It is theſe parcels of the Lungs thus diſtinguiſh'd from one another by the ſmall *Membranes* which enfold them, that are call'd the *Lobules* of the Lungs.

Theſe *Lobules* are all faſtned to large Trunks of the *Bronchiæ* as grapes to the ſtalk of the Cluſter. It is from theſe Trunks of the *Bronchiæ* that the ſmall branch proceeds, whoſe *Capillary* branches end in their *Veſicles.* The *Lobules* are likewiſe join'd together, by ſmall *Tendinous Filaments,* which keep their *Tunicles* contiguous. Therefore to diſcern them well they muſt be ſeparated with the point of a Pen-knife.

The *Bronchiæ* are every where accompanied with *Arteries* and *Veins:* So we need only trace the *Bronchiæ* to find the courſe of theſe Veſſels. By this means we find that their Extremities are ſpread into the Coats of the *Veſicles,* which compoſe the ſubſtance of the Lungs.

And becauſe the *Bronchiæ* are alſo accompanied with a *Nerve* which follows all their Ramifications, and is loſt into the *Veſicles* of the Lungs; and becauſe the inner *Tunicle* of the *Bronchiæ* is compoſed of *Tendinous Fibres,* in all appearance the *Veſicles* of the Lungs are made of nothing but a Texture of *Tendinous*

Fibres, *Filaments* of *Nerves*, ſome *Arteries* and ſome *Veins*.

When we blow into the *Trachæal Artery* all the *Lungs* ſwell, and all the *Veſicles* are fill'd with Air. From whence I conclude that there is a communication between the *Bronchiæ* and the *Veſicles*. And ſince we ſee that the *Trachæal Artery* communicates with the outward Air by the Mouth and Noſtrils, we may with reaſon conclude that all this *Apparatus* of the *Trachæal Artery* and the *Bronchiæ* has been made for conveying of the External Air into the *Veſicles* of the Lungs.

But becauſe we find that the *Longitudinal* and *Circular* Fibres of the *Trachæal Artery* and the *Bronchiæ*, muſt by their action ſhorten the *Bronchiæ* and render their Cavity more narrow, we are obliged to think that the External Air is thruſt out of the *Veſicles* of the Lungs. But ſince they were made to receive it, it appears that it re-enters as ſoon as 'tis out, and gets out as ſoon as it has re-entred, and continues thus to go in and out, as long as the Animal lives. And it is this Ingreſs of the Air and its Egreſs from the Lungs, which is call'd *Reſpiration*.

After we have thus examined the Structure of the Lungs, we have found indeed the force which thruſts out the Air, when it had entred the *Veſicles*, but we do not perceive what may be the force which makes it re-enter there. This makes us think that that force which preſſes the Air into the Lungs, is not to be ſought for in the Lungs themſelves, but in ſome other part.

In ſearching what this force may be, I conſider that the Lungs are ſhut up in a large Cavity call'd the *Breaſt*, and the *Breaſt* is ſo cloſely ſhut up on all ſides, that the Air cannot get into it but by the *Trachæal Artery*. By this I perceive that if the *Breaſt* dilate it ſelf it will preſs the External Air into the Lungs to fill the place, which the ſides of the *Breaſt* abandon, when it dilates its ſelf, juſt as the Air from without is drawn into the Hollow of a pair of bellows, by raiſing the Boards.

Indeed we find that the Air enters into the Lungs according as the *Breaſt* is enlarged, and goes out as it is ſtraitned. But becauſe it may be enlarged by the Air's entring into the Lungs, and diminiſhed by its going out, for the better determination of the point we muſt examine the ſtructure of the *Breaſt*.

DISCOURSE XVII.

Of the Breaſt.

THE firſt thing I meet with in examining the *Cavity* of the *Breaſt*, is a very ſlender *Membrane* which covers it on all ſides, and which *Anatomiſts* call the *Pleura*. This *Membrane* is doubled on the middle of the *Breaſt*. It extends its ſelf thus from the top of the *Breaſt* to the lower part of it, and divides it into two parts, of which the one is on the Right, the other on the Left-ſide; and this is call'd the *Separation*, the *Mediaſtinum*, or *Midriffe*.

On the out-ſide of the *Pleura* are the Ribs, which are inſerted on one ſide into the *Vertebræ*. They are bended in form of a *Parabola*, and are united by a Cartilaginous knot, to a Bone which covers the fore-part of the *Breaſt*, call'd *Sternum*. The Ribs touch one another towards the *Vertebræ*. They are ſeparated as they advance toward the *Sternum*. The ſpace which they leave between them is all fill'd with Muſcles, which keep them united to one another. The firſt which appear are eleven in number. They derive their Origin from the top and bottom of each inferiour Rib, and aſcending obliquely from behind to the Fore-part, they draw the Superiour Rib to the Inferiour. They are called the *Inner Intercoſtal Muſcles.*

Beyond the *inner Intercoſtals* are eleven Muſcles, call'd the *outer Intercoſtals.* They ariſe all from the Inferiour and outer part of each Superiour Rib, and are obliquely inſerted in the fore-part unto the Superiour and outer part of each Inferiour Rib. Their Fibres croſs thoſe of the *inner Intercoſtals*, in form of a *Burgundy* Croſs.

Theſe Muſcles can be of no other uſe by the contraction of their Fibres, but to incline the Ribs towards one another. But for as much as the Ribs are ſo ſituated that they cannot approach one another, but the Cavity of the *Breaſt* muſt be enlarged, we conclude that the uſe of the *Intercoſtal* Muſcles is to enlarge the *Breaſt*, by drawing the Ribs upward.

The *External Intercoſtals* are covered with many other Muſcles. We obſerve amongſt the reſt one of them which comes from the *Os Sacrum* and the Thorny *Apophyſes* of the Loins, and is inſerted into the upper Ribs near their Roots. It gives to each one of them a double *Tendon.* 'Tis call'd the *Sacro-Lumbar*; when it acts it removes the Ribs from one another by drawing them downward.

There is after this another, which derives its Origin from the middle of the *Sternum.* It is faſtned to the Cartilages of the true under Ribs, and to the ſecond and third of the baſtard ones. They give it the Name of the *Triangular Muſcle.*

After this appears a great large Muſcle, which ariſes from the inner Baſe of the *Homoplate*, and is joined to the five true inferiour Ribs, and to the two baſtard inferiour ones by five *Tendons* which reſemble the Teeth of a Saw, and is therefore call'd the *Great Teethed Muſcle*. And when it acts, it draws all the Ribs towards the *Homo-plate* to which it ſends the *Tendons*.

Then when we go back towards the top of the *Breaſt*, we find a Muſcle which derives its Origin from within the *Clavicle* near the *Acromion*, and is faſtned to the firſt Rib near the *Sternum*. Its uſe is to draw the firſt Rib upwards towards the *Clavicle*. They call it the *Subclavian*.

We find alſo another Muſcle which comes from the Thorn of the three Inferiour *Vertebræ* of the Neck, and the firſt of the Back. It is terminated by digitation into the three or four upper Ribs. They call it the upper ſmall Teethed Muſcle. It draws the Ribs into which it is inſerted upwards towards the Neck.

In fine, there is yet one which ariſeth from the three Inferiour *Vertebræ* of the Back and the firſt of the Loins, it is inſerted into the three or four Inferiour Ribs by digitation. It draws the Ribs into which it is inſerted outward. They call it the Inferiour ſmall Teethed Muſcle.

The Ribs are ſo diſpoſed that they cannot be moved upwards without enlarging the capacity of the *Breaſt*. And ſince the four laſt Muſcles of which we have ſpoken draw the Ribs upwards, we may truly affirm that their uſe is to enlarge the *Breaſt*, and the uſe of the others to diminiſh it.

The *Breaſt* is ſhut up below by a muſculous wall, call'd the *Diaphragm*. This wall is not always bended, as may appear, in that when the Animal is dead, it is Convex towards the *Breaſt*, and Concave on the other ſide; ſo that by its Convexity it takes up a part of the Capacity of the *Breaſt*.

Its figure is almoſt round. We obſerve in it two eſſential parts, the Carneous and the Tendinous. The Tendinous occupies the middle. It is Tranſparent and woven of Tendinous Fibres and Nervous Filaments. The Carneous part encompaſſeth the Tendinous. It extends its ſelf to the *Sternum*, to the Ribs, and to ſome *Vertebræ* of the Back, as well as to ſome of thoſe of the Loins. It is ſtrongly faſtned to all theſe parts. Its Fibres go in a ſtrait line from the Tendinous part, even to the places of their Inſertion.

From whence we may eaſily conclude that when the *Diaphragm* acts, the Carneous Fibres by their contraction draw the Tendinous part towards the ſides, and cauſe the *Diaphragm* to loſe its Convexity. And ſince thereby it leaves the place which it occupied in the *Breaſt*, this Cavity is conſiderably enlarged. Which makes us imagine that the *Diaphragm* ſerves by its action to enlarge the Cavity of the *Breaſt*.

The *Diaphragm* is brought down alſo by the action of the Muſcles which make the Ribs move upwards. The reaſon is that the Ribs cannot move after this manner without drawing the *Diaphragm* by its Extremities, which muſt of neceſſity make it loſe its Convexity.

We find therefore by the ſearch that we have made into the whole *Breaſt*, that it is compoſed of certain parts which enlarge the Cavity of it, and of other parts which diminiſh it. By this we ſo certainly know the way of Reſpiration, that we cannot almoſt doubt but it is performed after the following manner.

DISCOURSE XVIII.

Of Reſpiration.

WE diſtinguiſh two times in *Reſpiration.* The time of the entry of the Air into the *Breaſt*, call'd *Inſpiration*; and the time of its going out, call'd *Exſpiration.* The *Inſpiration* is made, when the *Subclavian*, the Great, the two ſmall Teethed, and the Intercoſtal Muſcles do unanimouſly draw the Ribs upwards. The *Diaphragm* is extended alſo at the ſame time by the riſing of the Ribs which draw it by its Extremities, and by the Spirits which do then run into its Fibres. So the Cavity of the *Breaſt* is enlarged and the external Air preſſed by the Walls of the Cavity of the *Breaſt*. It cannot move then but on the ſide where it meets with the leaſt reſiſtance. It finds none at the entry of the *Trachæal Artery*, and it rencounters every where elſe. There it enters, and goes into the *Bronchiæ*, from whence it paſſes into the *Veſicles* of the Lungs. It blows them up as much as is needful to fill up the vacant ſpace cauſed by the Deſertion of the Walls of the *Breaſt*. Even as the motion given to the two Boards of a pair of Bellows when they are raiſed from one another, thruſts as much Air into the

Bellows as is needful to fill the ſpace which the Boards of the Bellows have left.

By this means the Muſcles which ſerve to draw down the Ribs have their Fibres extremely ſtretcht to the length. The Fibres of the *Muſculous Tunicle* of the *Trachæal Artery* and of the *Bronchiæ*, are alſo greatly ſtretcht. They both by their ſpring rebound. The Nerves ſend ſome Spirits into their Cavity. They are ſhortned. By this Contraction the Ribs are forc'd downwards. The Cavity of the *Breaſt* is diminiſht, and the *Cartilages* of the *Bronchiæ* do re-enter into one another. So the Air which the *Veſicles* of the *Lungs* did contain is ſo preſt that it goes out. It paſſeth from the *Veſicles* into the *Bronchiæ*, from the *Bronchiæ* into the *Trachæal Artery*, and from thence out of the Body. And this we call *Exſpiration.*

Since *Reſpiration* is nothing but *Inſpiration*, immediately followed by *Exſpiration*, and this *Exſpiration* followed as quickly by a new *Inſpiration*, and ſo forward; we may very well affirm that *Reſpiration* is made by means of the *Muſcles* of the *Breaſt*, of the *Diaphragm*, of the *muſculous Tunicle*, of the *Trachæal Artery* and of the *Bronchiæ*. Theſe Organs act ſucceſſively. And the action of the one hinders the action of the other. From whence we conclude that we may reaſonably conſider them as *Antagoniſt Muſcles*.

All the Blood which paſſeth through the *right Ventricle* of the Heart, goeth from thence into the *Lungs*, and the *Lungs* receive the *External Air* into their *Veſicles :* So that we may juſtly ſuppoſe that this Air produceth ſome change in the Blood which paſſeth through the Lungs.

We find indeed a great difference between the Blood which enters into the Lungs, and that which comes out of them. That which enters by the *Pulmonary Artery* is of a pretty deep red, whereas that which returns from the Lungs by the *Pulmonary Vein* is of a bright and faint Red.

See here a very conſiderable change which happens to the Blood in paſſing through the Lungs, which can be made no otherwiſe but by the Air which blows up their *Veſicles*, and by this means preſſeth the ſmall *Arteries*, and the ſmall *Veins* which are ſpread there. This preſſure mingles more exactly the Principles of Blood, and obliges it to run quicker into the branches of the *Pulmonary Vein*, and from thence into the left *Ventricle* of the Heart.

But becauſe this exact mixture of the Principles of the Blood and this paſſage from the *Arteries* into the *Veins*, is not capable of producing the change that we have taken notice of; ſome Principle of Air extremely ſubtile, muſt certainly mingle with it. This Principle may paſs through the *Pores* of the *Arteries*, and inſinuate its ſelf among the parts of the Blood.

That which makes the thing yet more probable is, that the Blood which is expoſed to the Air acquires a ſurface extremely Red and like in colour to that which comes from the *Lungs* by the *Pulmonary Vein*. By which we ſee that the Air produces in the Blood a bright and florid Red by being mingled with it.

Since therefore the Air produces this effect, we cannot in reaſon doubt, but the change of colour which happens in the Blood's paſſing through the Lungs, comes from the Air which ſwells its *Veſicles*.

All the difference between the Blood of the *Veins* and that of the *Arteries*, is the ſame with that of the Blood which enters the *Lungs*, and of that which comes from them. So we may truly affirm that this difference is made in the *Lungs* and not in the *Ventricles* of the *Heart*, where the Blood does not receive any Alteration. For if you take Blood out of the *Vena Cava*, and afterwards out of the *Pulmonary Artery*, you ſhall find no difference between theſe two Bloods; notwithſtanding that which is taken out of the *Pulmonary Artery* has paſt through the *right Ventricle* of the *Heart*. Laſtly, if you take of the Blood of the *Pulmonary Vein* and afterwards of the *Aorta*, you ſhall ſee that theſe two Bloods are alike in all things, though the one has been taken at its entry into the *left Ventricle* of the *Heart*, and the other at its going out.

It remains as yet to examine what are the principles of Air which produce the change that the Blood contracts in paſſing through the *Lungs*. When we conſider the Air narrowly, we find amongſt many principles which compoſe it a *Nitrous Spirit* ſpread through all its Maſs. There are in *Phyſick* and *Chymiſtry* a prodigious number of Experiments, which render the thing certain. And becauſe the *Spirit* of *Nitre* produces in the Blood the ſame change with the Air, we have reaſon to think that the change which the Air makes in the Blood as it paſſes through the *Lungs*, proceeds from the *Nitrous Spirit* of the Air's mingling with it.

The *Spirit* of *Nitre* is compoſed of *Acids* and *Alcali's*. The *Alcali's* rarifie the *Sulphurs* of the Blood, and the *Acids* ferment with its *Volatile Alcali's*. The Blood becomes thereby more ſubtile, more agitated and more rarified.

From all this we may conclude that the *Reſpiration* ſerves to make the Blood paſs from the *Pulmonary Artery* into the *Pulmonary Vein*, and to keep up the fermentation of it by means of the *Nitrous Spirit* which mingles it ſelf with it. And ſince this Spirit heightens the Red colour of the Blood, it may be alſo ſaid that the *Reſpiration* ſerves to maintain it, and that by its means the *Lympha* and *Chyle* which mingle with it, take by degrees its Colour and Nature.

DISCOURSE XIX.

Of the Spleen.

WHen we follow the Blood, which goes out of the left *Ventricle* of the Heart, we find that the firſt Entrail, of thoſe which we have not yet examined, to which it goes, is the *Spleen*. It is of a red Colour, of a conſiderable bigneſs, plac'd in the lower Belly, on the left ſide, and a little lower than the Liver.

In the *Spleen* there is an *Artery* and a *Nerve*, which enter jointly into it, and a *Vein* which goes out at the ſame place. Theſe *Arteries* end in little *Membranous* Cells, whoſe Figure nearly reſembles the Leaf of the Fearn. The *Vein* derives its Origine from the ſame Cells. This appears when we blow into the *Artery*, or the *Vein*, for the Breath paſſeth into the Cells.

Theſe Cells are all filled with ſmall *Glandules* heaped upon one another, like a Cluſter of

Grapes. Theſe *Glandules* receive ſmall Branches of *Arteries* from the Trunk of the *Splenical Artery*, and *Nervous Filaments* from the *Nerve* which enters with the *Artery* into the *Spleen.* From each heap of theſe *Glandules* goes a root of a *Vein*, which being join'd together, compoſe the Splenick Vein.

On the Surface of the *Spleen* we perceive many *Lymphatick* Veſſels, which empty their *Lympha* into *Pecquet*'s *Reſervatory.*

By what we have ſaid, it appears, that nothing enters into the *Spleen*, but the Animal Spirits which come by the *Nerves*, and the Blood which comes thither by the *Arteries.* There goes nothing out alſo but the *Lympha* which runs by the *Lymphatick* Veſſels into the *Reſervatory* of the *Chyle*, and the Blood which goes by the *Splenical Vein.* The *Lympha* is nothing but the Remains of the *Nutritive Juyce* of the *Spleen*, and it appears not to have any other quality in this place, than what it has every where elſe. As for the Blood, it has the ſame colour and conſiſtence which we obſerve in other *Veins.*

Theſe Obſervations do extremely perplex us as to the uſe of the *Spleen.* For if the *Arteries* bring Blood unto it, it may be ſaid, that this is but to nouriſh it, and if the Nerves bring thither Animal Spirits, this is but to give the *Nutritive Juyce*, the neceſſary fluidity?

So that we find nothing yet but what ſimply ſerves to the Nouriſhment of this part.

Yet we cannot ſay that it is entirely uſeleſs. For 'tis not likely that an uſeleſs part ſhould ſtill be found in the Body of a living Creature always of the ſame frame and in the ſame ſituation. Nature, it is like, would not have been ſo exact in this matter, if it ſerved for nothing. So that it is probable it has in the Animal Oeconomy ſome uſe which we do not know.

But becauſe on ſuch occaſions we muſt be ſatisfied with conjectures till we find better, we may ſuppoſe that a ferment diſtils from the *Veſicles* of the *Glandules* and that it mingles with the Blood which paſſeth through the Spleen. That the nature of this ferment is ſuch that it diſentangleth from the other parts of the Blood, the parts which are proper to compoſe the *Bile*.

The reaſon which makes us of this opinion, is, becauſe all the Blood which goes from the *Spleen* paſſes into the *Vena Porta* and from thence to the Liver, where we know it rids it ſelf of thoſe parts which are fitteſt to compoſe the *Bile*. But this ſentiment, though the moſt probable, has many difficulties.

All know that an Animal can live many years after the taking out of the *Spleen*; but this is nothing as to its Uſe or Inutility, ſince the cutting out of the *Pancreas*, whoſe uſes are known, and which is acknowledged to be moſt neceſſary for the maintaining of the Animal Oeconomy, does not hinder a Dog from living many years.

DISCOURSE XX.

Of the Reins, *and* Ureters.

THere are in the lower Belly two Bodies made like to French beans plac'd upon the loins, on the two ſides of the deſcending *Aorta*, and the aſcending *Vena Cava*. Theſe Bodies receive *Arteries* from the *Aorta*, call'd the *Emulgent Arteries*, and ſend Veins to the *Vena Cava*, call'd the *Emulgent Veins:* And theſe Bodies are called the *Reins*.

We find them firſt wrapt up in a *Tunicle* which covers the whole Cavity of the lower Belly. Next to this there is another *Tunicle* which immediately covers them. And laſtly, when we have taken off theſe two *Tunicles* we diſcover the ſurface of the *Reins*, upon which we have the pleaſure to obſerve an agreeable ramification of *Sanguineous Veſſels*.

Theſe *Sanguineous Veſſels* enter into the *Reins* upon their Concave ſide which looks towards the *Aorta* and the *Vena Cava*. Many ſmall *Nerves* go from the *Plexus Renalis* accompanying them all along as they paſs. They are all ſhut up in a ſmall *Membranous* Cover, and the *Nerves* are loſt in its ſubſtance. Afterwards theſe Veſſels are ſpread through the outer ſubſtance of the *Reins* and enter into ſmall *Glandules*, of which this whole outer ſubſtance is compoſed.

Theſe *Glandules* are faſtned to the Veſſels as the Grapes to the Trunk of the Cluſter. By this means they make ſmall *Lobes* wrapt up in a particular *Tunicle*. This *Tunicle* enters partly into the *Capſula*, and partly into the Cavity of the *Reins*, which they call the *Baſon*. All theſe ſmall *Lobes* cleave to one or other of theſe by ſmall *Tendinous Filaments*.

From each *Glandule* goes an Excretory Veſſel. They deſcend in a ſtraight line to the Baſon, being plac'd one cloſe by another. When they come near to pierce the *Tunicle* which makes its inward Cover, many of them join together and make up a great Pipe. This Pipe has an opening by which it communicates with the Baſon, about which opening we find a little Riſing, call'd *Papilla*.

The Cavity of the Baſon is covered with a very thick *Tunicle*. It is formed of the Expanſion of the ſmall Pipes which pierce it. It is afterwards ſo much contracted towards the Concave ſide of the *Reins*, that it takes the form of a Veſſel of the bigneſs of a Gooſe feather. It deſcends in the form of an *S*, and goes into a Bag, placed in the lower part of the *Abdomen*, under the *Pecten*, call'd the *Bladder*.

Theſe Veſſels they call the *Ureters*. They are wrapt up in the *Peritonæum*, and in a proper *Tunicle*, which communicates with that which immediately covers the *Reins*. Their Subſtance is *Membranous* and very Thick. Their *Fibres* are ſo variouſly interwoven that they keep no order.

The uſe of the *Reins* is to ſeparate a Saltiſh Seroſity from the Blood, which paſſeth from the *Glandules* into the Baſon, and from thence runs by the *Ureters* into the Bladder. This Liquor they call *Urine*.

DISCOURSE XXI.

Of the Bladder, *and of the* Urine.

THE *Bladder* is a Bag receiving the *Urine*, ſeparated by the *Reins* from the Blood. Its Figure is like to that of a Pear; and is ſo Situated, that its wider part, call'd the *Bladder*, is always upwards, and its narrower part call'd the Neck of the *Bladder*, is always downwards.

It is kept in this poſture by two conſiderable Ligaments. The firſt goes from its bottom to the Navel, and hinders it from falling downwards. The ſecond is very ſhort. In Men it keeps it fixt upon the *Rectum*, in Women upon the *Matrix*, ſo that the *Bladder* cannot turn either to the left or right ſide. The firſt is inſerted into its fore-part, and the ſecond into its hinder part.

The *Bladder* is made up of three *Tunicles*. The firſt is only a production of the *Peritonæum*, which enwraps it outwardly. It is compoſed of Tendinous Fibres variouſly interwoven. The middle *Tunicle* is made of Carneous Fibres. Of theſe they reckon three Orders. The firſt is of ſome large Fibres placed on the fore-part of the *Bladder*, which go in a ſtrait line from its bottom as far as the Neck of it. The ſecond is of Fibres which ſurround the *Bladder* Circularly, and may be called *Circular Fibres*. And the third plac'd under the *Circular*, is of Fibres which croſs the former obliquely, going from the left to the right, from the bottom of the *Bladder* as far as its neck. We ſhall call them Tranſverſe Fibres. Laſtly, the inner *Tunicle* is compoſed of *Tendinous* Fibres, of ſuch a Texture as has not been yet diſcovered. When the *Bladder* is not blown up, it is all wrinkled, and within it is always covered with a *Mucilage*.

At the neck of the *Bladder* there is a Muſcle made of ſtrong and *Circular* Fibres. It is a *Sphincter* which keeps it always ſhut.

From all this we may conclude that the *Bladder* is a Concave Muſcle, whoſe outer and inner *Tunicles* are *Tendons*, and the middle *Tunicle*, the Belly.

The Inſertion of the *Ureters* into the *Bladder*, ſufficiently ſhews that its uſe is to be the *Reſervatory* of the *Urine*, and that all we have obſerved in its frame, tends to no other end but to keep the *Urine* in its Cavity, and to thruſt it forth when it is therewith filled.

I ſay that the *Bladder* is the *Reſervatory* of the *Urine*, becauſe the *Ureters* are inſerted into its Cavity after ſuch a manner, as that the *Urine* can eaſily enter there, but cannot return again into the *Ureters*. They creep for ſome ſpace between the outer and middle *Tunicles*, afterwards they pierce the middle *Tunicles*, and creep a little farther between it and the inner, which they pierce towards the neck of the *Bladder*. So the *Urine* can paſs without much difficulty from the *Ureters* into the *Bladder*. But as the *Bladder* ſwells by the abundance of *Urine* it ſtraitens the ends of the *Ureters* which creep amongſt its *Tunicles*, ſo that the *Urine* in the *Bladder* cannot enter there.

The *Sphincter* of the *Bladder* is the cauſe that the *Urine* makes ſome ſtay in its Cavity. And leſt in ſtaying there its ſalts ſhould prick the inner *Tunicle*, nature has conveyed thither the *Mucilage* which anoints it on all ſides.

The *Longitudinal Fibres* ſhorten the Body of the *Bladder* when the *Animal Spirits* contract them. The *Circular* and the *Tranſverſe* do by their action ſtraiten it. So when the *Fibres* are filled with *Spirits* the *Bladder* is leſſened in all reſpects. And if then there be *Urine* in its Cavity, it makes way notwithſtanding the oppoſition of the *Sphincter*, and gets out of the Body by a ſmall Pipe call'd the *Urethra.*

This Pipe is only the Continuation of the inner *Tunicle* of the *Bladder*. In Women its opening is in the *Pudendum*, and in Men it extends its ſelf into the Body of the Yard, and terminates in the end of the *Balanus*.

By what has been ſaid we ſee that the *Reins*, the *Ureters*, the *Bladder* and the *Urethra*, have been made to ſeparate the *Urine* from the *Blood*, and to convey it out of the Body, not only as uſeleſs, but even as hurtful to the maintaining of the *Animal Oeconomy*.

To underſtand theſe truths aright, it is to be obſerved that the *Urine* is compoſed of little elſe but *Phlegms* and *Volatile Salts*; having but very little of *Sulphur*, *Earth*, and *fixt Salt.*

The *Nitrous Spirit* which mingles with the *Blood* in the *Lungs* is compoſed of *Acids* and *Alcali's.* Its *Acids* coming to join with the *Alcali's* of the *Blood* make a *Salt.* And becauſe moſt part of the *Alcaline* parts of the *Blood* are *Volatile*, the *Salt* which is made of them is alſo *Volatile.* Theſe *Volatile Salts* might diminiſh the natural Fermentation of the *Blood* and ſtop its Courſe. To prevent this miſchief the Author of Nature has plac'd the *Reins* into the Bodies of Animals, which ſeparate theſe *Saline* parts from the Maſs of the *Blood.* And ſeeing alſo a too great abundance of *Phlegm*, would make the *Blood* too ſlow and hinder the *Spirits* from acting, the *Reins* do not only ſeparate the *Salts*, but alſo the *Phlegms*, which are the two Principles whoſe too great abundance would be capable of choaking the ordinary Fermentation of the Humours, upon which the life of Animals depends.

Moreover it is obſerved that when the *Urine* abounds with *Alcali's*, that is to ſay, when its *Salts* are not ſtrongly charged with *Acids*, it is thick and troubled. And when it has a deal of *Acids*, that is, when its *Salts* are well furniſht with them, it is more clear and Tranſparent. And when there is much *Salt* in a little *Phlegm*, the *Urine* is of a reddiſh

Colour. And when there is much *Phlegm* and little *Salt*, it is clear, and very near the ordinary Colour of Water.

There is found in the *Urine* a little Cloud, made of ſome parts of the *Mucilage*, which we have ſaid is in the *Bladder*. The *Salts* of the *Urine* diſchage them by little and little, and carry them along with them. This *Cloud* appears when the *Urine* begins to cool, becauſe the coolneſs condenſes it, and thereby renders it more viſible.

FINIS.

Books Printed for Walter Kettilby, *at the* Biſhop's-*Head in St.* Paul's *Church-Yard.*

AN Idea of a Philoſophical Hiſtory of Plants read before the Royal Society, *January* 8. and *Jan.* 15. 1672. by *Nehemiah Grew*, M. D. Fellow of the Royal Society, and of the College of Phyſicians.

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Three Anatomick Lectures concerning, Firſt, The Motion of the Blood through the Veins and Arteries. Secondly, The Organic ſtructure of the Heart. Thirdly, The Efficient Cauſes of the Hearts Pulſation, Read on the 19. 20. and 21. days of *March*, 1682. In the Anatomick Theatre of His Majeſty's Royal College of Phyſicians in *London*. By *Walter Charleton*, M. D. and of the ſame College.

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